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Scientific and Technical Aerospace Reports

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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INTRODUCTION

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The authority for the indexing vocabulary used in the subject index of this issue of *STAR* is the *NASA Thesaurus*. The most recent version is the *NASA Thesaurus—Alphabetical Update* (NASA SP-7040), September 1971, which is available from NTIS as accession number N72-15923 for $6.00 in paper copy. The current cross-reference structuring for each term appears in this volume, together with additional approved terms that may be used in indexing documents announced in other issues of *STAR*. NASA SP-7040 supersedes the first two volumes (subject terms A–Z) of the three-volume *Preliminary Edition of the NASA Thesaurus* (NASA SP-7030), December 1967. Volume III of the Preliminary Edition presented the following aids to vocabulary selection of the 1967 terms: hierarchical display of index terms, category terms listing, and permuted index; this has not been updated but may still be useful.

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Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 1808
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

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29 Space Radiation 1827
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30 Space Sciences 1829
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 1834
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 1836
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

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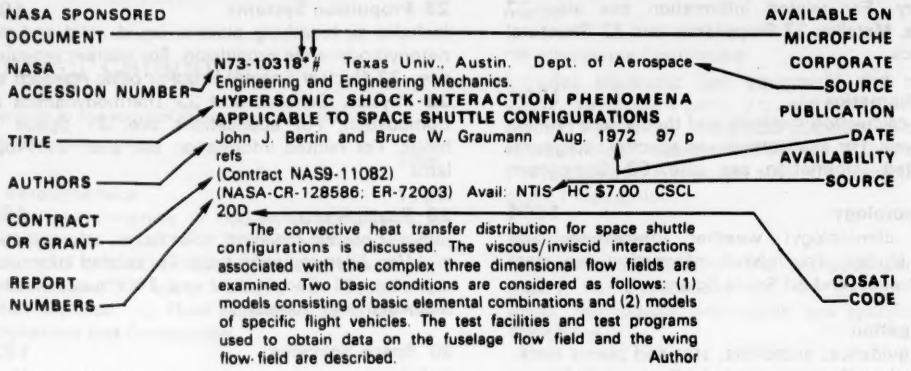
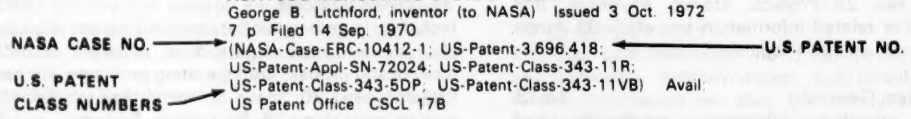


N73-10318*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
HYPERSONIC SHOCK-INTERACTION PHENOMENA APPLICABLE TO SPACE SHUTTLE CONFIGURATIONS
John J. Bertin and Bruce W. Graumann Aug. 1972 97 p refs
(Contract NAS9-11082)
(NASA-CR-128586; ER-72003) Avail: NTIS HC $7.00 CSCL 20D

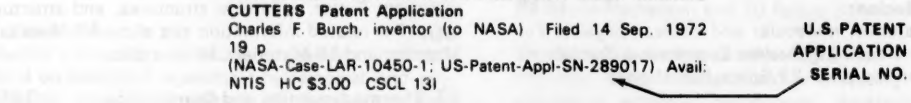
The convective heat transfer distribution for space shuttle configurations is discussed. The viscous/inviscid interactions associated with the complex three dimensional flow fields are examined. Two basic conditions are considered as follows: (1) models consisting of basic elemental combinations and (2) models of specific flight vehicles. The test facilities and test programs used to obtain data on the fuselage flow field and the wing flow-field are described. Author

PATENT CITATION



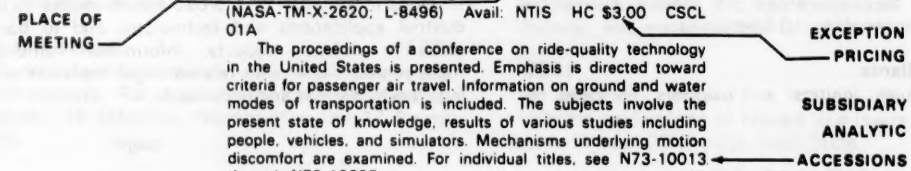
N73-12211* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ALTITUDE MEASURING SYSTEM Patent
George B. Litchford, inventor (to NASA) Issued 3 Oct. 1972 7 p Filed 14 Sep. 1970
(NASA-Case-ERC-10412-1; US-Patent-3,696,418; US-Patent-Appl-SN-72024; US-Patent-Class-343-11R; US-Patent-Class-343-5DP; US-Patent-Class-343-11VB) Avail: US Patent Office CSCL 17B

PATENT APPLICATION CITATION



N73-10504*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GRINDING ARRARGEMENT FOR BALL NOSE MILLING CUTTERS Patent Application
Charles F. Burch, inventor (to NASA) Filed 14 Sep. 1972 19 p
(NASA-Case-LAR-10450-1; US-Patent-Appl-SN-289017) Avail: NTIS HC $3.00 CSCL 13I

PRIMARY ANALYTIC CITATION AND ABSTRACT



N73-10012*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SYMPOSIUM ON VEHICLE RIDE QUALITY
Washington Oct. 1972 256 p refs Symp. held at Hampton, Va., 6-7 Jul. 1972
(NASA-TM-X-2620; L-8496) Avail: NTIS HC $3.00 CSCL 01A

The proceedings of a conference on ride-quality technology in the United States is presented. Emphasis is directed toward criteria for passenger air travel. Information on ground and water modes of transportation is included. The subjects involve the present state of knowledge, results of various studies including people, vehicles, and simulators. Mechanisms underlying motion discomfort are examined. For individual titles, see N73-10013 through N73-10025.

SUBSIDIARY ANALYTIC CITATION

N73-10014* Douglas Aircraft Co., Inc., Long Beach, Calif.
AN AIRCRAFT MANUFACTURER'S APPROACH TO RIDEABILITY CRITERIA
R. C. OMassey, H. Leve, and J. G. Gaume *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 23-49 refs (For availability see N73-10012 01-02)
CSCL 01A

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Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N73-23994*+ National Aeronautics and Space Administration, Washington, D.C.
A CUMULATIVE INDEX TO THE 1972 ISSUES OF AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY
Jan. 1973 730 p refs
(NASA-SP-7037(27)) Avail: NTIS HC $9.00 CSCL 01A

A cumulative index to the abstracts contained in NASA SP-7037 (15) through NASA SP-7037 (26) of Aeronautical Engineering: A Special Bibliography. NASA SP-7037 and its supplements have been compiled through the cooperative efforts of the American Institute of Aeronautics and Astronautics (AIAA) and the National Aeronautics and Space Administration (NASA). This cumulative index includes subject, personal author, corporate source, contract, and report number indexes. Author

N73-23995# Aeronautical Research Council, London (England).
[RESEARCH PROGRESS ON AERODYNAMIC HEATING, AIRFOILS, WINGS, AND AIRCRAFT DURING 1960, VOLUME 1] Technical Report, 1960
HMSO 1972 775 p refs
Avail: NTIS HC $40.75; HMSO £18; PHI $69.77

Research projects involving aerodynamics, aerodynamic heating, air flow, boundary layer flow, and heat transfer are discussed. Emphasis is placed on investigations of pressure distribution and flow characteristics of various airfoils and wing planforms under subsonic and supersonic flight conditions. Structural analyses of airframes to show the effects of flutter, thermal stresses, and fatigue are reported. The stability and control characteristics of helicopters and swept wing aircraft are described. For individual titles, see N73-23996 through N73-24010.

N73-23996 Ministry of Aviation, London (England).
MEASUREMENT OF AERODYNAMIC HEATING ON THE NOSE OF A DELTA AIRCRAFT AT SPEEDS UP TO M EQUALS 1.65
J. E. Nethaway and O. P. Nicholas *In* ARC Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 1-12 ref Supersedes RAE-TN-Aero-2693; ARC-22617 (For availability see N73-23995 15-01)
(ARC-R/M-3280; RAE-TN-Aero-2693; ARC-22617)

Skin temperature measurements recorded during a climb and level-flight acceleration at 40,000 feet, at speeds up to M = 1.65 are presented. The temperatures were measured at 27 points on the skin of the aircraft nose, on a diaphragm forming part of the nose internal structure and inside the nose. Measurements were first made with the skin clean, and then with it painted. Comparison with estimates of boundary-layer temperature shows that during accelerations of about 0.3 meters/minute the skin temperature lagged behind the estimated value by about 5 C, for the clean skin, and by about 9 C for the painted skin. The maximum skin temperature reached was about 100 C above ambient. Agreement between measured and calculated skin temperatures was good. Author

N73-23997 Oxford Univ. (England). Dept. of Engineering Science.
SOME CONVERGENCE PROBLEMS IN THE NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS c12
W. G. S. Lester *In* ARC Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 13-22 refs Supersedes QUEL-135; ARC-22069 (For availability see N73-23995 15-01)
(ARC-R/M-3239; QUEL-135; ARC-22069)

The convergence of numerical solutions of the Navier-Stokes equations for steady two-dimensional flow is examined and convergence criteria for both psi and zeta are obtained for a rectangular mesh. The criterion for psi is shown to be less stringent, in general, than that for zeta. A method of solution, based on the process used to obtain the convergence criteria, is derived. This method widens the range over which convergence can be obtained and can also be used to accelerate the convergence rate. Author

N73-23998 Oxford Univ. (England). Dept. of Engineering Science.
THE FLOW PAST A PITOT TUBE AT LOW REYNOLDS NUMBER c12
W. G. S. Lester *In* ARC Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 23-44 refs Supersedes QUEL-136; ARC-22070 (For availability see N73-23995 15-01)
(ARC-R/M-3240; QUEL-136; ARC-22070)

Numerical methods used to solve the Navier-Stokes equations for steady viscous two-dimensional flow are extended to include the case of axial symmetry. The equations and their finite difference approximations are derived working in cylindrical polar co-ordinates with the Stokes' stream function and the vorticity as variables. A method of dealing with the boundary conditions is given. Author

N73-23999 National Physical Lab., Teddington (England). Aerodynamics Div.
ON THE FLOW IN A REFLECTED SHOCK TUNNEL c12
D. W. Holder and D. L. Schultz *In* ARC Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 45-78 refs Supersedes ARC-22152 (For availability see N73-23995 15-01)
(ARC-R/M-3265; ARC-22152)

The performance of a shock tunnel operated by the reflected-shock technique is examined theoretically neglecting viscous effects and high-temperature real-gas effects. Particular attention is given to disturbances to the flow at the nozzle entry caused by waves reflected from the contact surface when the operating conditions depart from those for tailoring. For unheated hydrogen driving air, the results suggest that the first disturbance reflected from the contact surface is weak enough to be tolerated only within a small range of primary-shock Mach number if the pressure at entry to the nozzle is to remain constant to plus or

minus 10 percent. Within this range, running times much longer than those obtained in straight-through shock tunnels are predicted, the limitation usually being imposed by the arrival of the expansion wave originating at the diaphragm. Outside this range of Mach number, the uniform-flow duration between the arrival at the nozzle entry of the primary shock and the first disturbance reflected from the contact surface is shock to be approximately equal to the time between the arrival of the primary shock and the contact surface in a straight-through shock tunnel. Author

N73-24000 Ministry of Aviation, London (England).
THE PRESSURE DISTRIBUTION ON TWO DIMENSIONAL WINGS NEAR THE GROUND
J. A. Bagley *In* ARC Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 79-118 refs Supersedes RAE-Aero-2625; ARC-22060 (For availability see N73-23995 15-01)
(ARC-R/M-3238; RAE-Aero-2625; ARC-22060)

A method of calculating the pressure distribution in in-compressible flow on two-dimensional airfoils of arbitrary section at moderate distances from the ground is developed. Comparisons with an exact potential-flow solution, and with measurements on a 10 percent thick airfoil of RAE 101 section, provide a satisfactory verification of the adequacy of method. It is shown that it is necessary to take account of the boundary layer on the airfoil in the calculations. Author

N73-24001 National Physical Lab., Teddington (England). Aerodynamics Div.
PRESSURE DISTRIBUTION AND SURFACE FLOW ON 5 PERCENT AND 9 PERCENT THICK WINGS AND CURVED TIP AND 60 DEG SWEEPBACK
H. C. Garner and D. E. Walshe *In* ARC Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 119-212 refs Supersedes ARC-20982; ARC-21562 (For availability see N73-23995 15-01)
(ARC-R/M-3244; ARC-20982; ARC-21562)

Extensive tables are given of pressure coefficients measured at Reynolds numbers from 1.3 x one million to 3.9 x one million on two half-models of identical planform with 5 percent RAE 101 and 9 percent RAE 101 streamwise sections. The planform of aspect ratio 3.899 has a straight trailing edge with 60 deg of sweepback, constant chord over most of the span and a parabolic outer portion of the leading edge curving to a pointed tip. The overall wing characteristics are obtained from integrated normal pressures and are compared with lifting-surface theory. The low-speed experimental pressure distributions and surface oil-flow patterns are analysed and discussed in relation to the onset of separation and the distinct vortex flows that develop at high incidence. Series of contrasting upper-surface isobars illustrate some features of the different stalling processes of the two wings. The direct influence of the main vortex on local surface pressures is assessed in general terms. A fuller appraisal of secondary surface flow is obtained from the oil patterns, observations in water and measurements of high suction near the trailing edge. Author

N73-24002 Ministry of Aviation, London (England).
PROPERTIES OF A TWO PARAMETER FAMILY OF THIN CONICALLY CAMBERED DELTA WINGS BY SLENDER BODY THEORY
J. C. Cooke *In* ARC Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 213-247 refs Supersedes RAE-TN-Aero-2698; ARC-22327 (For availability see N73-23995 15-01)
(ARC-R/M-3249; RAE-TN-Aero-2698; ARC-22327)

Slender theory with exact boundary conditions is used to calculate the flow past a thin conically cambered delta wing. The spanwise camber-line consists of a straight central part with two drooping pieces at the sides, the points of junction being termed the shoulders. The shape is not given at the start but is the result of a series of conformal transformations. Attention is concentrated on flow which is attached at the leading edge. Incidence and lift and drag coefficients are worked out for this condition. It is found that, for a given lift coefficient, moving the shoulder outboard reduces the droop and droop angle required and also reduces the error introduced by neglecting second order terms. For low lift coefficients the lowest drag is obtained with shoulder position well outboard, but for high lift coefficients least drag is obtained when the shoulder position is along the center-line and the camber-line reduces to a circular arc. Author

N73-24003 National Physical Lab., Teddington (England). Aerodynamics Div.
A STUDY OF THE EFFECT OF LEADING EDGE MODIFICATIONS ON THE FLOW OVER A 50-DEG SWEPTBACK WING AT TRANSONIC SPEEDS **c02**
E. W. E. Rogers, C. J. Berry, and J. E. G. Townsend *In* ARC Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 249-328 refs Supersedes ARC-21987 (For availability see N73-23995 15-01)
(ARC-R/M-3270; ARC-21987)

A wind tunnel investigation has been made of the effects of leading-edge modifications on the flow and forces on an untapered wing of 50 deg leading-edge sweep, at stream Mach numbers between 0.60 and 1.20. Seven leading-edge profiles were tested, ranging from a drooped extension of 18 percent of the chord of the basic sharp-nosed section to a round-nosed section with a leading-edge radius of 1.0 percent of the basic chord. Leading-edge droop was found to increase the wing drag near zero lift but to reduce appreciably the lift-dependent drag component, except at the highest test Mach numbers. Droop also increased the lift coefficient at which leading-edge separation occurred on the upper surface at moderate subsonic speeds, but in addition reduced the Mach number for transonic flow attachment. The appearance of the forward shock (but not the rear shock) is considerably delayed when the leading edge is drooped. With the undrooped sections an increase in leading-edge radius was accompanied by successively earlier appearances of the forward shock, and hence the outboard shock with its attendant separation. The conditions at which the rear shock first appeared changed only slowly as the section was changed. The variations in wing flow pattern as the leading edge is modified are discussed and related to measured changes in the wing lift and drag. Author

N73-24004 National Physical Lab., Teddington (England). Aerodynamics Div.
THE FLOW PATTERN ON A TAPERED SWEPTBACK WING AT MACH NUMBERS BETWEEN 0.6 AND 1.6, PART 1. EXPERIMENTS WITH A TAPERED SWEPTBACK WING OF WARREN 12 PLANFORM AT MACH NUMBERS BETWEEN 0.6 AND 1.6, PART 2 **c02**
I. M. Hall and E. W. E. Rogers *In* ARC Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 329-487 refs Supersedes ARC-19691; ARC-22050 (For availability see N73-23995 15-01)
(ARC-R/M-3271; ARC-19691; ARC-22050)

The development of the flow pattern on a swept wing with incidence and stream Mach number is described. The wing, of aspect ratio 2.828, taper ratio 0.333 and leading-edge sweep 53.5 deg, was tested at Mach numbers between 0.6 and 1.6 at incidences up to about 12 deg. The test Reynolds number varied with Mach number, being typically 2.3 x one million at Mach = 1.0. Boundary-layer transition was fixed by a roughness band at the leading edge. It is shown that the flow pattern at moderate incidences develops smoothly from a subsonic type involving leading-edge separation to a supersonic type where the flow is attached near the leading edge and with shock-induced separation further aft. The formation and movement of the shock-wave system and the vortices near the wing surface are briefly discussed. Author

N73-24005 Ministry of Aviation, London (England).
FREE FLIGHT MEASUREMENTS OF THE TRANSONIC ROLL DAMPING CHARACTERISTICS OF THREE RELATED WINGS OF ASPECT RATIO 2.83 **c02**
K. J. Turner and G. K. Hunt *In* ARC Res. Progr. on Aerodyn. Heating Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 489-500 refs Supersedes RAE-TN-Aero-2683, ARC-22117 (For availability see N73-23995 15-01)
(ARC-R/M-3274; RAE-TN-Aero-2683; ARC-22117)

Measurements of the roll-damping derivative of three wing planforms were made by the free-flight roll-balance technique over the Mach number range 0.7 to 1.4. The wings were all of

RAE 102 section, 7.5 percent thickness to chord and aspect ratio 2.83 but varied in sweep and taper ratio. The two wings of taper ratio 0.33 showed little loss of damping in the transonic region but the 50 deg delta wing suffered a 50 percent loss of damping at Mach = 0.96. The results have been compared with simple theoretical estimates and the effects of aero-elasticity have been computed. Author

N73-24006 Aeronautical Research Council, London (England).
SOME APPLICATIONS OF NOT-SO-SLENDER WING THEORY TO WINGS WITH CURVED LEADING EDGES
L. C. Squire *In its* Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 501-524 refs Supersedes RAE-TN-Aero-2703; ARC-22437 (For availability see N73-23995 15-01)
(ARC-R/M-3278; RAE-TN-Aero-2703; ARC-22437)

An extension of slender-wing theory, has been applied to some problems concerned with the properties of slender, lifting, wings with curved leading edges at supersonic speeds. Two particular problems are considered. These are the calculation of the change in lift, aerodynamic center, and load distribution on uncambered wings as the Mach number increases above M = 1.0 and the calculation of the camber shape to produce a given load distribution at a given Mach number. Where possible the results are compared with linear theory and with experimental results, and the limitations of the extension are discussed.
Author

N73-24007 Aeronautical Research Council, London (England).
TRANSONIC TUNNEL TESTS ON A 6 PERCENT THICK, WARPED 55 DEG SWEPTBACK WING MODEL
A. B. Haines and J. C. M. Jones *In its* Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 525-564 refs Supersedes ARA-25; ARC-22466 (For availability see N73-23995 15-01)
(ARC-R/M-3385; ARA-25; ARC-22466)

Wind tunnel tests have been made on a model having a 6 percent thick, 55 deg sweptback wing with a warp distribution designed to give a constant spanwise C sub L distribution and a triangular chordwise load at C sub L = 0.15, M = 1.2. The wing-body junction was designed according to supersonic area rule for this Mach number. The results can be considered as encouraging. Subcritical-type flow is maintained over most of the wing under the design conditions. The margins in both Mach number at the design C sub L and C sub L at the design Mach number before the start of any serious supercritical increase in drag or before the appearance of any significant shock-induced separations are of the order of 0.05. Major changes in the pitching-moment characteristics are even further delayed. At subsonic speeds and low C sub L, K is near 1.2 while at the design conditions, the approximate value from the experimental results is K = 1.55 as compared with a theoretical prediction of K = 1.33. The results suggest that it is unlikely that there was a sizeable sweep factor on the wing skin-friction drag through no firm conclusion can be drawn about this. Author

N73-24008 National Physical Lab., Teddington (England). Aerodynamics Div.
AN INVESTIGATION OF THE FLOW ABOUT A PLANE HALF WING OF CROPPED DELTA PLANFORM AND 6 PERCENT SYMMETRICAL SECTION AT STREAM MACH NUMBERS BETWEEN 0.8 AND 1.41 c02
E. W. E. Rogers, I. M. Hall, and C. J. Berry *In* ARC Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 565-652 refs Supersedes ARC-22191 (For availability see N73-23995 15-01)
(ARC-R/M-3286; ARC-22191)

A study has been made of the flow development over the wing as the incidence and stream Mach number vary and this is illustrated by surface pressure distributions and oil-flow patterns. The growth and movement of the two main surface shocks (the rear and forward shocks) is discussed, and conditions for slow separation through these shocks are considered. For the rear shock, which has little sweep, these conditions are similar to those for shock-induced separation on two-dimensional airfoils. The forward shock is comparatively highly swept and separation seems to correspond to two rather different but simultaneously-attained conditions, one related to the component Mach number normal to the shock front and the other to the position of the reattachment line. The flow in the region between the leading edge and the forward shock is shown to have certain characteristics analogous to those found upstream of the shock on two-dimensional airfoils. To the rear of the forward shock, but ahead of the rear shock, the flow at low supersonic speeds resembles in some respects that about a simple cone. Author

N73-24009 Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
EXPERIMENTS ON A DELTA WING WITH JET ASSISTED LIFT c02
W. H. Melbourne *In* ARC Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 653-700 refs Supersedes ARC-21968; Rept-101 (For availability see N73-23995 15-01)
(ARC-R/M-3288; ARC-21968; Rept-101)

The effect of blowing a jet stream, simulating conventional jet engines, downwards from the lower surface of a slender delta wing (aspect ratio unity), for the purpose of obtaining additional lift at take-off and landing was examined. Initial experiments investigated a spanwise jet sheet blown respectively from 70, 80 and 90 percent of the mid-chord from the apex, and a trailing-edge jet flap. It was found that a spanwise jet flown forward of the trailing edge was inefficient in providing lift. A flow investigation showed that this was associated with a region of the low pressure behind the jet and a strong vortex at the outer edge of the jet. Further experiments were then carried out using a narrow chordwise jet sheet and a concentrated group of jets on the wing center-line, to avoid the adverse effects of the spanwise jet. The concentrated jets proved far more efficient than the other two arrangements. Author

N73-24010 Royal Aircraft Establishment, Farnborough (England).
A CONTRIBUTION TO THE THEORY OF AIRCRAFT RESPONSE IN ROLLING MANOEUVRES INCLUDING INERTIA CROSS COUPLING EFFECTS
H. H. B. M. Thomas and P. Price *In* ARC Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 701-762 refs Supersedes RAE-Aero-2634; ARC-22301 (For availability see N73-23995 15-01)
(ARC-R/M-3349; RAE-Aero-2634; ARC-22301)

The problem of calculating the response of an aircraft in rolling maneuvers when the mass distribution of the aircraft is such that the inertia terms in the equations of motion effect a cross-coupling of the usual lateral and longitudinal motions is considered. Solutions are outlined to two formulations of this problem: (1) response to a given applied aileron and (2) response corresponding to a specified time history of rate of roll. Detailed calculations are made only for the first of these, and the results compare favourably with digital-computer solutions. Possible simplifications to the method of calculation are discussed.
Author

N73-24011# Aeronautical Research Council, London (England).
[RESEARCH ON AERODYNAMIC CHARACTERISTICS AND CONTROL, BOUNDARY LAYERS, AND INSTRUMENTS DURING 1960, VOLUME 2] Technical Report, 1960
HMSO 1972 783 p refs
Avail: NTIS HC $41.25; HMSO £19; 1 PHI $75.07

Research projects in aerodynamic subjects are discussed. The topics reported include the following: (1) boundary layer flow, (2) heat transfer during aerodynamic heating, (3) effects of atmospheric turbulence on aerodynamic loads, (4) lateral stability characteristics of delta wings, (5) structural analysis of airframes for optimum design, and (6) performance of slotted transonic wind tunnel working section. For individual titles, see N73-24012 through N73-24032.

N73-24012 Ministry of Aviation, London (England).
EFFECTS OF HEAT TRANSFER ON LAMINAR BOUNDARY-LAYER DEVELOPMENT UNDER PRESSURE GRADIENTS IN COMPRESSIBLE FLOW c12
R. J. Monaghan *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layer, and Instruments during 1960, Vol. 2 1972 p 763-797 refs Supersedes RAE-Aero-2640; ARC-21974 (For availability see N73-24011 15-01)
(ARC-R/M-3218; RAE-Aero-2640; ARC-21974)

An approximate analysis shows that momentum thickness, skin friction and heat transfer of the compressible laminar boundary layer developing under pressure gradients may be given by formulas formally the same as those obtaining under zero pressure gradient condition if an appropriate length transformation is applied to the x-coordinate. Also, the formulas for skin friction and heat transfer include factors I and h respectively, which are functions of a pressure gradient parameter m. If pressure gradients are adverse, then the value of m at natural separation is an additional parameter in the determination of the skin-friction parameter I, but h is approximately a constant, equal to its zero pressure gradient value, in this region. Comparisons are made also for an external velocity variation. Author

N73-24013 Queen Mary Coll., London (England). Dept. of Aeronautical Engineering.
GENERALISED METHODS FOR THE CALCULATION OF THE LAMINAR COMPRESSIBLE BOUNDARY-LAYER CHARACTERISTICS WITH HEAT TRANSFER AND NON-UNIFORM PRESSURE DISTRIBUTION c12
R. E. Luxton and A. D. Young *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 799-832 refs Previously issued as ARC-20336; ARC-21563 (For availability see N73-24011 15-01)
(ARC-R/M-3233; ARC-20336; ARC-21563)

Methods are presented for calculating the skin friction and other characteristics on the laminar boundary layer on a nonadiabatic wall of constant temperature in the pressure gradients. There is a need for a method of similar simplicity which can be applied to round nosed wings, that is to flows starting from a stagnation point and accelerating to supersonic velocities downstream and hence involving large changes in free stream pressure and Mach number. To meet this need, the restrictive assumptions of the method have been relaxed and correction factors incorporated to allow for the effects of the pressure gradient on certain parameters previously assumed to be unaffected by the pressure gradient. The resulting method involves the solution of a single quadrature in a step-by-step manner and is applicable with a high degree of accuracy to a very wide range of flows with Mach numbers from zero to five, with heat transfer to or from the surface, and with both favorable and adverse pressure gradients. Author

N73-24014 Cambridge Univ. (England). Engineering Lab.
THE ANALYSIS OF BLADE VIBRATION DUE TO RANDOM EXCITATION c32
D. S. Whitehead *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 833-848 refs Previously issued as ARC-22119 (For availability see N73-24011 15-01)
(ARC-R/M-3253; ARC-22119)

The experimental measurement of the power spectra of waveforms derived from vibrating blades in axial compressors under running conditions was conducted. This enables the damping factor of the blades to be found, and these damping factors agree reasonably well with theoretical estimates of the aerodynamic damping. There is no significant decrease in the damping factor when the blades stall. Theoretical estimations of the length of data which has to be examined to get accurate measurements of the rms amplitude and the power spectrum are included. The amount of data required is much greater for the power spectrum, but even for the rms amplitude it is surprisingly long. A theoretical prediction of the effect of variations of air density and blade material density under otherwise similar conditions is presented. Author

N73-24015 Cambridge Univ. (England). Dept. of Engineering.
FORCE AND MOMENT COEFFICIENTS FOR VIBRATING AEROFOILS IN CASCADE c32
D. S. Whitehead *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 849-885 refs Previously issued as ARC-22133 (For availability see N73-24011 15-01)
(ARC-R/M-3254; ARC-22133)

A method is given for calculating the aerodynamic forces and moments acting on installed vibrating cascade blades. The forces and moments due to both bending and torsional vibration are calculated. Wakes from periodic obstructions far upstream which move relative to the cascade in question are analyzed. Tables of the force and moment coefficients for two space/chord ratios are presented. The coefficients can be used to predict the occurrence of pure torsional or coupled flutter and the vibration induced by periodic disturbance in the flow. Author

N73-24016 Ministry of Aviation, London (England).
THEORY AND TUNNEL TESTS OF ROTOR BLADES FOR SUPERSONIC TURBINES c28
B. S. Stratford and G. E. Sansome *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 887-928 refs Previously issued as NGTE-245; ARC-22537 (For availability see N73-24011 15-01)
(ARC-R/M-3275; NGTE-R-245; ARC-22537)

In special circumstances where a large work output is required from a turbine in a single stage it is necessary to use high pressure ratios across the nozzle blades, thus producing supersonic velocities at inlet to the rotor. As part of an investigation into such turbines, several designs for the inter-blade passage of the rotor have been tested in a two-dimensional tunnel, a design theory being developed concurrently. The first design, featuring constant passage width and curvature as in steam-turbine practice, but having thin leading and trailing edges, was found to suffer from focusing of the compression waves from the concave surface, with consequent flow separation from the opposite convex surface. It gave a velocity coefficient of 0.929-based upon the area-mean total pressure as measured at an inlet Mach number of 1.90 and turning angle of 140 deg. The measured value compares favourably with values from previous steam tests, where the results have been in the range from 0.65 to 0.92. Author

N73-24017 Ministry of Aviation, London (England).
BEHAVIOUR OF SKIN FATIGUE CRACKS AT THE CORNERS OF WINDOWS IN A COMET 1 FUSELAGE c32
R. J. Atkinson, W. J. Winkworth, and G. M. Norris *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 929-963 refs Previously issued as RAE-R-STRUCT-257; ARC-22270 (For availability see N73-24011 15-01)
(ARC-R/M-3248; RAE-STRUCT-257; ARC-22270)

Fatigue tests on a Comet 1 aircraft pressure cabin subjected to operational pressure cycles are described. Cracks at window corners are the main subject of investigation. Results are compared with earlier experiments on other Comet 1 aircraft pressure cabins. Conclusions are reached that appeared to have some general significance. Author

N73-24018 Ministry of Aviation, London (England).
A NOTE ON FLUTTER OF ASYMMETRIC CONTROLS c02
E. G. Broadbent and E. V. Hartley *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 965-974 refs Previously issued as RAE-TN-STRUCT-278; ARC-22084 (For availability see N73-24011 15-01)
(ARC-R/M-3256; RAE-TN-STRUCT-278; ARC-22084)

Methods for approximating an aircraft with an asymmetric elevator control for the purpose of flutter calculations are discussed. Two examples of asymmetric controls that are common in practice are described. Four calculations for an asymmetric tail are developed for the following modes: (1) symmetric modes, (2) antisymmetric modes, (3) the same modes as (1) but for only half the aircraft, and (4) the same modes as (2) for only half the aircraft. Author

N73-24019 National Physical Lab., Teddington (England). Aerodynamics Div.
CALCULATION OF STABILITY DERIVATIVES FOR TAPERED WINGS OF HEXAGONAL PLANFORM OSCILLATING IN A SUPERSONIC STREAM
Doris E. Lehrian *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 975-1020 refs Previously issued as ARC-22186 (For availability see N73-24011 15-01)
(ARC-R/M-3298; ARC-22186)

The aerodynamic loading is formulated for a family of symmatrically tapered wings describing simple hormonic pitching oscillations of low frequency in supersonic flow. The planforms have supersonic leading and trailing edges of constant sweep, the variable parameters being the angle of rake of the side edges and the ratio of span to root chord. For Mach numbers up to 2.4 the investigation covers supersonic and subsonic side edge which act as leading edges, streamwise tips or trailing edges. The lift and moment are evaluated to first order in frequency on the basis of linearized thin-wing theory. In the case of subsonic trailing side edges, it is more convenient to obtain the total forces by use of the reverse-flow theorem. The theoretical values of the pitching-moment derivatives are compared with experimental results obtained on half-wing models with alternative pitching axes and a basic 5 percent double-wedge section. An estimate of thickness effect is calculated by applying two-dimensional aerofoil theory on a strip-theory basis. When corrected for thickness the theoretical values are in good agreement with the experimental derivatives for Mach numbers greater than 1.6. Author

N73-24020 National Physical Lab., Teddington (England). Aerodynamics Div.
WIND-TUNNEL TECHNIQUES FOR THE MEASUREMENT OF OSCILLATORY DERIVATIVES
J. B. Bratt *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1021-1073 refs Supersedes ARC-22146 (For availability see N73-24011 15-01)
(ARC-R/M-3319; ARC-22146)

The basic principles employed in techniques for the measurement of oscillatory derivatives in wind tunnels and the associated instrumentation are described. The suitability of the various techniques for different test conditions is also discussed, and brief reference is made to wind-tunnel effects on the measurements. Author

N73-24021 Ministry of Aviation, London (England).
AN EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER FROM THE INSIDE SURFACE OF A HOT SMOOTH TUBE TO AIR, HELIUM AND CARBON DIOXIDE c12
J. F. Barnes *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1075-1111 refs Previously issued as NGTE-R241; ARC-21991 (For availability see N73-24011 15-01)
(ARC-R/M-3246; NGTE-R-241; ARC-21991)

Experimental values of Nusselt number as a function of Reynolds number and surface/gas temperature ratio for three gases, air, helium and carbon dioxide are given, and the effects of radial variations of fluid properties with temperature are shown. The conditions under which the experiments were performed were fully developed velocity and temperature profiles and subsonic turbulent flow. These conditions are typical of those encountered in the cooling passages of a nuclear reactor or a turbine blade. The experimental results are presented in a form suitable for use in design work and are compared with existing experimental and theoretical data. Author

N73-24022 Ministry of Aviation, London (England).
THE LONGITUDINAL STABILITY AND CONTROL OF THE TANDEM-ROTOR HELICOPTER, PART 1. THE LATERAL STABILITY AND CONTROL OF THE TANDEM-ROTOR HELICOPTER, PART 2 c02
A. R. S. Bramwell *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1113-1211 refs Previously issued as RAE-NAVAL-3;ARC-21943;RAE-NAVAL-4; ARC-21918 (For availability see N73-24011 15-01)
(ARC-R/M-3223; RAE-NAVAL-3; ARC-21943; RAE-NAVAL-4; ARC-21918)

A simple method of calculating downwash interference is presented and comparison of theoretical and flight test trim curves indicates that the method is reasonably accurate. Since the stability of the tandem-rotor helicopter depends largely on small differences between the thrusts of the front and rear rotors it is necessary to calculate the rotor thrust derivatives far more accurately than for the single-rotor helicopter. The downwash interference causes a reversal of stick position with speed for part of the speed range with an associated divergence in the dynamic stability. This may be eliminated by choosing a suitable value of swash-plate dihedral angle. If, in addition, a suitable differential delta-three hinge angle is applied the tandem-rotor helicopter appears to be stable over the whole speed range except at hovering and very low speeds. Author

N73-24023 Ministry of Aviation, London (England).
THE HEMISPHERICAL, DIFFERENTIAL PRESSURE YAWMETER AT SUPERSONIC SPEED c12
L. J. Beecham *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1213-1230 refs Previsously issued as RAE-TN-Aero; ARC-22184 (For availability see N73-24011 15-01)
(ARC-R/M-3237; RAE-TN-Aero-2687; ARC-22184)

Available data on the pressure distribution around a hemisphere at supersonic speeds are reviewed with special reference to the differential pressure. A modified form of pressure coefficient is used which collapses the data down to low supersonic speeds, and suggests that the normalized yawmeter sensitivity can be made virtually independent of Mach number by suitable orifice location. Author

N73-24024 Cambridge Univ. (England). Engineering Lab.
A NARROW-BAND SPECTRAL ANALYZER FOR RANDOM WAVEFORMS c14
D. S. Whitehead *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1231-1246 refs Previously issued as ARC-22120 (For availability see N73-24011 15-01)
(ARC-R/M-3259; ARC-22120)

An analyzer which was developed for finding the power spectra of waveforms derived from vibrating axial compressor blades due to random excitation is described. The bandwidth of the instrument goes down to about 0.04 cps. The standard deviation of the results is considered in some detail, and it is shown that long samples of data are required in order to get reasonably accurate results. Author

N73-24025 National Physical Lab., Teddington (England). Aerodynamics Div.
TURBULENT WALL JETS WITH AND WITHOUT AN EXTERNAL STREAM c12
P. Bradshaw and M. T. Gee *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1247-1294 refs Previously issued as ARC-22008 (For availability see N73-24011 15-01)
(ARC-R/M-3252; ARC-22008)

Results are presented of experiments on wall jets in still air on flat and curved surfaces, and beneath an external stream in presence and absence of pressure gradient and initial boundary layer. It was found that the Reynolds shear stress is not zero at the velocity extremes, invalidating the simple assumptions of layer independence. It is concluded that a satisfactory calculation method is not immediately practicable. The behavior of wall jets is discussed in some detail on the basis of the experimental results. Author

N73-24026 Ministry of Aviation, London (England).
THE RELATIONSHIP BETWEEN THE DISCRETE GUST AND POWER SPECTRA PRESENTATIONS OF ATMOSPHERIC TURBULENCE, WITH A SUGGESTED MODEL OF LOW-ALTITUDE TURBULENCE c20
J. K. Zbrozek *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1295-1318 refs Previously issued as RAE-TN-Aero-2682; ARC-21874 (For availability see N73-24011 15-01)
(ARC-R/M-3216; RAE-TN-Aero-2682; ARC-21874)

The relation between the discrete gust and the spectral presentations of atmospheric turbulence is discussed, and the limitations of the discrete gust approach are explained. The available measurements of low altitude turbulence are analyzed. The relationships between the three components of turbulence at low altitude and the effect of wind are considered. Author

N73-24027 Ministry of Aviation, London (England).
FLIGHT TESTS TO INVESTIGATE THE DYNAMIC LATERAL-STABILITY CHARACTERISTICS OF A 45-DEG DELTA,

CROPPED TO GIVE THREE ASPECT RATIOS c02
J. E. Nethaway and J. Clark *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1319-1335 refs Previously issued as RAE-TN-Aero-2671; ARC-21990 (For availability see N73-24011 15-01)
(ARC-R/M-3243; RAE-TN-Aero-2671; ARC-21990)

Flight test to determine the dynamic lateral-stability characteristics of the Boulton-Paul 3A aircraft, have been made at aspect ratios 3.8, 3.0 and 2.3. They showed that the changes in damping, period and phase angle were not large when the aspect ratio was varied, but the roll to yaw ratio increased considerably as aspect ratio was reduced. The comparison between the characteristics measured in flight, and those estimated, is generally fair. Agreement is closest over the range of lift coefficient 0.25 to 0.45. Author

N73-24028 Aeronautical Research Council, London (England).
A THEORETICAL INVESTIGATION OF THE LONGITUDINAL STABILITY, CONTROL AND RESPONSE CHARACTERISTICS OF JET-FLAP AIRCRAFT, PARTS 1 AND 2 c02
A. S. Taylor *In its* Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1337-1436 refs Previously issued as RAE-Aero-2600; RAE-TN-Aero-2670; ARC-19925; ARC-21867 (For availability see N73-24011 15-01)
(ARC-R/M-3272; RAE-Aero-2600; RAE-TN-Aero-2670; ARC-19925; ARC-21867)

A theoretical analysis of the stability, control, and response characteristics of jet flap aircraft is presented. The restrictions imposed by the use of two dimensional theoretical lift and moment data as the basis of tractable stability and control analyses are examined. Considerations of trim, static stability, and quasi-steady maneuverability are discussed to show effects of jet controls as compared with tail controls. The mathematical theory and mathematical models which support the aerodynamic responses are developed. Graphs and tables of aerodynamic characteristics are included. Author

N73-24029 Aeronautical Research Council, London (England).
THE DESIGN OF MICHELL OPTIMUM STRUCTURES c32
In its Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1437-1476 refs Previously issued as Rept-142; ARC-22596 (For availability see N73-24011 15-01)
(ARC-R/M-3303; Rept-142; ARC-22596)

The determination of structure of minimum weight which safely equilibrate a given system of external forces is discussed. The theorem of Michell for the basic requirements of such a structure is described. The geometrical layout of two dimensional structures which satisfy these requirements and the application of the theory of plane plastic flow are analyzed. Expressions for the calculation of sizes and the total volume of the structural members are developed. A method of graphical construction of the structural layout is given. Solutions for a cantilever under tip shear force and a beam under uniform bending moment are provided. Comparisons with the conventional types of construction are made and the superiority of the Michell structures are demonstrated. Author

N73-24030 Ministry of Aviation, London (England).
THERMAL STRESSES NEAR THE ROOTS OF RECTANGULAR WINGS c33
G. G. Pope *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1477-1494 refs Previously issued as RAE-STRUCT-254; ARC-22143 (For availability see N73-24011 15-01)
(ARC-R/M-3236; RAE-STRUCT-254; ARC-22143)

A continuous solution is derived for the stress distribution in a simple wing surface represented by a uniformly reinforced strip bounded by equal constant area edge members, when the sections in the airstream experience a uniform temperature rise. The section shielded by the fuselage is assumed to remain at a constant temperature. This analysis, which takes into account the bending, shear and direct stiffness of the edge members, is used to evaluate the shear stress distribution in a specific strip used as an example. The stress distribution in this same specimen strip is also calculated by the Argyris matrix force method assuming a finite spanwise temperature gradient at the edges of the fuselage, both for a constant chordwise temperature and for a parabolic chordwise temperature variation in the airstream. Author

N73-24031 Aeronautical Research Council, London (England).
THERMAL BUCKLING OF CIRCULAR PLATES c32
B. Cotterell and E. W. Parkes *In its* Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1495-1507 Previously issued as ARC-22246 (For availability see N73-24011 15-01)
(ARC-R/M-3245; ARC-22246)

The post-buckling behaviour of a circular plate is investigated for two conditions: (1) heating over the center, and (2) heating at the edge. In the former cases the plate buckles into the form of a saucer; in the latter into a saddle shape. The plate may be free or it may be subjected to a variety of edge restraints. For center heating, edge restraint has little effect on the behavior; for edge heating it is extremely important. General nondimensional curves are presented for the deflected form and bending stresses. Experiments carried out on plates under center heating generally support the analyses. Author

N73-24032 Ministry of Aviation, London (England).
PERFORMANCE OF THE 36 BY 35 INCHES SLOTTED TRANSONIC WORKING SECTION OF THE RAE BEDFORD 3-FOOT WIND TUNNEL c11
E. P. Sutton, M. T. Caiger, and A. Stanbrook *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1509-1531 refs Previously issued as RAE-Aero-2622; ARC-21908 (For availability see N73-24011 15-01)
(ARC-R/M-3228; RAE-Aero-2622; ARC-21908)

The performance of the working section of a three foot, variable-pressure, supersonic wind tunnel is discussed. The wind tunnel has slotted walls on all four sides and the effect of varying the angles of inclination of the upper and lower walls to the tunnel axis is analyzed. It was determined that a good standard of flow uniformity was obtained when the upper and lower walls were set at a small angle of divergence. The variations in Mach number in the area of the working section occupied by the model did not exceed 0.01 at Mach numbers up to 1.2. Author

N73-24033*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OVERALL AND BLADE-ELEMENT PERFORMANCE OF A MULTIPLE-CIRCULAR-ARC BLADED TRANSONIC COMPRESSOR ROTOR WITH TIP SPEED OF 1375 FEET PER SECOND
George Kovich and Lonnie Reid Washington May 1973 86 p refs
(NASA-TM-X-2697; E-7155) Avail: NTIS HC $3.00 CSCL 20D

The design and experimental performance of a 20-inch-diameter multiple-circular-arc bladed axial-flow transonic compressor rotor is presented. Radial surveys of the flow conditions were made. At design speed the peak efficiency was 0.882 and occurred at a weight flow of 64.0 pounds per second. At this point the total-pressure and total-temperature ratios were 1.79 and 1.205, respectively. The stall margin at design speed was 8 percent based on weight flows and total-pressure ratios at experimental peak efficiency and near stall. The measured stall margin was 20 percent at design weight flow and speed. Author

N73-24034*# Dynatech Corp., Cambridge, Mass.
ANALYSIS AND TESTING OF TWO-DIMENSIONAL SLOT NOZZLE EJECTORS WITH VARIABLE AREA MIXING SECTIONS
Gerald B. Gilbert and Philip G. Hill Washington NASA May 1973 136 p refs
(Contract NAS2-6660)
(NASA-CR-2251) Avail: NTIS HC $3.00 CSCL 20D

Finite difference computer techniques have been used to calculate the detailed performance of air to air two-dimensional ejectors with symmetric variable area mixing sections and coaxial coverging primary nozzles. The analysis of the primary nozzle

assumed correct expansion of the flow and is suitable for subsonic and slightly supersonic velocity levels. The variation of the mixing section channel walls is assumed to be gradual so that the static pressure can be assumed uniform on planes perpendicular to the axis. A test program was run to provide two-dimensional ejector test data for verification of the computer analysis. A primary converging nozzle with a discharge geometry of 0.125 inch x 8.0 inch was supplied with 600 SCFM of air at about 35 psia and 180 F. This nozzle was combined with two mixing section geometries with throat sizes of 1.25 inch x 8.0 inch and 1.875 inch x 8.0 inch and was tested at a total of 11 operating points. Author

N73-24035*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC EFFECTS OF FIVE LIFT-FAN POD ARRANGEMENTS ON AN UNPOWERED V/STOL TRANSPORT MODEL
James L. Thomas, Danny R. Hoad (Army Air Mobility R and D Lab., Fort Eustis, Va.), and Delwin R. Croom Washington Jun. 1973 64 p refs
(NASA-TN-D-7199; L-8754) Avail: NTIS HC $3.00 CSCL 01A

An investigation was conducted in the Langley V/STOL tunnel to determine the effect of longitudinally oriented wing-mounted pods on the longitudinal and lateral aerodynamic characteristics in the cruise flight condition of a high-wing V/STOL transport model. Five pod arrangements were tested - three configurations with in-line pods at 20, 40, or 60 percent semispan and two split pod configurations with rear pods at 20 percent semispan and front pods at 40 or 60 percent semispan. In general, addition of the pods to the model decreased the stability, increased the lift-curve slope, and alleviated the abrupt stall of the basic model. The configuration with pods at 20 percent semispan had an abrupt instability at 10 deg angle of attack. All the configurations had lateral stability at sideslip angles from 5 to -5 deg. Very little difference in results existed between the configurations with pods at 40 and 60 percent semispan. Of the split pod configurations, the configuration with front pods at 40 percent semispan offered the best trimmed lift and lift-induced drag characteristics at high angles of attack. The configuration with in-line pods at 40 or 60 percent semispan provided the best cruise characteristics of all the pod configurations. Author

N73-24036*# General Motors Corp., Indianapolis, Ind. Detroit Diesel Allison Div.
DESIGN AND EXPERIMENTAL RESULTS FOR A TURBINE WITH JET FLAP STATOR AND JET FLAP
James L. Bettner and Jerry O. Blessing Washington NASA May 1973 165 p refs
(Contract NAS3-14303)
(NASA-CR-2244; EDR-7389) Avail: NTIS HC $3.00 CSCL 01C

The overall performance and detailed stator performance of a negative hub reaction turbine design featuring a moderately low solidity jet flap stator and a jet flap rotor were determined. Testing was conducted over a range of turbine expansion ratios at design speed. At each expansion ratio, the stator jet flow and rotor jet flow ranged up to about 7 and 8 percent, respectively, of the turbine inlet flow. The performance of the jet flap stator/jet flap rotor turbine was compared with that of a turbine which used the same jet flap rotor and a conventional, high solidity plan stator. The effect on performance of increased axial spacing between the jet stator and rotor was also investigated. Author

N73-24037*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
LOCAL FLOW MEASUREMENTS AT THE INLET SPIKE TIP OF A MACH 3 SUPERSONIC CRUISE AIRPLANE
Harold J. Johnson and Earl J. Montoya Washington May 1973 42 p refs
(NASA-TN-D-6987; H-722) Avail: NTIS HC $3.00 CSCL 01C

The flow field at the left inlet spike tip of a YF-12A airplane was examined using at 26 deg included angle conical flow sensor to obtain measurements at free-stream Mach numbers from 1.6 to 3.0. Local flow angularity, Mach number, impact pressure, and mass flow were determined and compared with free-stream values. Local flow changes occurred at the same time as free-stream changes. The local flow usually approached the spike centerline from the upper outboard side because of spike cant and toe-in. Free-stream Mach number influenced the local flow angularity; as Mach number increased above 2.2, local angle of attack increased and local sideslip angle decreased. Local Mach number was generally 3 percent less than free-stream Mach number. Impact-pressure ratio and mass flow ratio increased as free-stream Mach number increased above 2.2, indicating a beneficial forebody compression effect. No degradation of the spike tip instrumentation was observed after more than 40 flights in the high-speed thermal environment encountered by the airplane. The sensor is rugged, simple, and sensitive to small flow changes. It can provide accurate imputs necessary to control an inlet. Author

N73-24038# Weapons Research Establishment, Salisbury (Australia). Dept. of Supply.
THE ESTIMATION OF VISCOUS NORMAL FORCE, PITCHING MOMENT, SIDE FORCE AND YAWING MOMENT ON BODIES OF REVOLUTION AT INCIDENCES UP TO 90 DEG
K. D. Thomson Oct. 1972 85 p refs
(WRE-Rept-782(WR/D)) Avail: NTIS HC $6.25

Semi-empirical methods based on an adaptation of the impulse flow analogy are derived for estimating the distribution of cross-flow drag and the viscous forces and moments on bodies of revolution. The methods are applicable to flows in which the cross-flow component of free stream Mach number does not exceed 0.8. Flows with laminar or turbulent separations or transitional flows if the region of transition is known - can be examined. Corrections are included for the effects of both favourable and unfavourable pressure gradients due to noses, stabilizing flares and boattails, and therefore general streamlined bodies of revolution can be examined. Three different types of flow field are identified as the incidence is increased from 0 to 90 deg and a method is given for predicting the viscous normal force and pitching moment contribution in each field. Many comparisons with experiment reveal that the methods are generally accurate and have wide application. Author

N73-24039# Sandia Labs., Albuquerque, N.Mex.
MAGNUS THEORY FOR BODIES OF REVOLUTION
H. R. Vaughn and G. E. Reis Jan. 1973 65 p refs
(SC-RR-72-0537) Avail: NTIS

An analysis is presented predicting Magnus force and moment coefficients for a spinning ogive cylinder, cone cylinder, and conical bodies with laminar, transitional and turbulent boundary layers. The results compare favorably with experimental data. Author

N73-24040# Air Vehicle Corp., San Diego, Calif.
AN EXACT METHOD OF DESIGNING AIRFOILS WITH GIVEN VELOCITY DISTRIBUTION IN INCOMPRESSIBLE FLOW: AN EXTENSION OF THE LIGHTHILL AND ARLINGER METHODS Final Report, 15 Jun. - 15 Dec. 1972
T. Strand Dec. 1972 81 p
(Contract N00600-71-C-0709)
(AD-757813) Avail: NTIS CSCL 20/4

The inverse problem of airfoil theory, i.e., from a given surface velocity distribution determine the airfoil shape, is solved by conformal mapping procedures. The method is based upon prior works by Arlinger, which in turn is an extension of Lighthill's basic development. It involves the use of least squares and Lagrangian multipliers to modify the prescribed velocity distribution along a portion of the lower surface of the airfoil, thus ensuring that the modifications required for profile closure are minimized. The method developed should be of particular importance for calculating the shapes of new types of airfoils with high design lift coefficients. (Author Modified Abstract) GRA

N73-24046 Service Technique Aeronautique, Paris (France).
THE ESTIMATION OF AERODYNAMIC COEFFICIENTS NECESSARY FOR PERFORMANCE CALCULATIONS
C. Lievens *In* AGARD Aircraft Performance: Prediction Methods and Optimization Mar. 1973 28 p In FRENCH (For availability see N73-24042 15-02)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N73-24041 Purdue Univ., Lafayette, Ind.
DESIGN OF STABILITY AUGMENTATION SYSTEMS FOR DECOUPLING AIRCRAFT RESPONSES Ph.D. Thesis
Rhall Edward Pope 1972 166 p
Avail: Univ. Microfilms Order No. 72-30960

During the landing phase of flight, STOL aircraft exhibit undesirable coupled response in both the longitudinal and lateral-directional modes of flight. There is also a need for stability augmentation for these aircraft due to low longitudinal and directional dynamic stability and low static longitudinal stability. Application of Gilbert's decoupling procedure is proposed to eliminate the undesirable coupling effects and to develop a simpler method of designing a stability augmentation system. Five decoupled configurations were investigated. In the longitudinal mode, pitch response controlled by longitudinal stick was decoupled, first, from angle of attack, second, from flight path angle, and third from airspeed all of which were controlled by throttle. In the lateral directional mode, roll response controlled by lateral stick was decoupled first from yaw, and second from sideslip which were both controlled by rudder pedals.
Dissert. Abstr.

N73-24042# Advisory Group for Aerospace Research and Development, Paris (France).
AIRCRAFT PERFORMANCE: PREDICTION METHODS AND OPTIMIZATION
J. Williams, ed. Mar. 1973 345 p refs In ENGLISH and partly in FRENCH
(AGARD-LS-56) Avail: NTIS HC $19.25

The development and application of aircraft performance prediction methods are developed. The methods are applied to subsonic and supersonic aircraft. The basic topics discussed include: (1) range and radius capabilities, (2) takeoff and landing operations, and (3) aircraft maneuvers. Problems of aerodynamic prediction, aircraft mass estimation, and engine selection are included. Parametric and optimization techniques for aircraft design synthesis are reported. For individual titles, see N73-24043 through N73-24054.

N73-24043 Ministry of Defence, London (England). Project Performance Analysis Section.
RANGE AND RADIUS-OF-ACTION PERFORMANCE PREDICTION FOR TRANSPORT AND COMBAT AIRCRAFT
Robert K. Page *In* AGARD Aircraft Performance: Prediction Methods and Optimization Mar. 1973 32 p refs (For availability see N73-24042 15-02)

Numerical methods for determining the range and radius of action performance of transport and combat aircraft are presented. The data required for the prediction process are explained. Conditions which govern the choice of method to be used are analyzed. The following parameters are examined to show the effect on aircraft range: (1) optimum cruising speeds, (2) cruise height schedules and integrated range, (3) effect of various aircraft and engine characteristics. Mathematical models are included to support the theoretical concepts and tables of data are provided to show application of data. Author

N73-24044 Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
AIRFIELD PERFORMANCE PREDICTION METHODS FOR TRANSPORT AND COMBAT AIRCRAFT
John Williams *In* AGARD Aircraft Performance: Prediction Methods and Optimization Mar. 1973 56 p refs (For availability see N73-24042 15-02)

Methods for evaluating and predicting the airfield performance of turbojet and turbofan aircraft operating in conventional and short takeoff modes are developed. Airfield performance parameters include: (1) accelerating and decelerating ground run, (2) rotation to liftoff and from touchdown, (3) airborne flare, up and out, and (4) climb and descent approach. The aircraft configurations to which the data apply are described. The factors involved in airfield performance prediction are formulated separately for takeoff and landing operations. The sensitivity of airfield performance comparisons to the specific choice of technical and operational assumptions is illustrated. Author

N73-24045 Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Flight Mechanics Dept.
FLIGHT MANOEUVRE AND CLIMB PERFORMANCE PREDICTION
Heribert Friedel *In* AGARD Aircraft Performance: Prediction Methods and Optimization Mar. 1973 51 p refs (For availability see N73-24042 15-02)

Methods for predicting aircraft flight maneuver and climb performance are presented. The methods are based on the equations of motion in a vertical and in a horizontal plane. The problems concerning the point performance values are explained. The relationship between excess power and load factor and their influence on climb and turn performance are discussed. Methods for evaluating the Mach-dependent performance values and the related optimum values are reported. Author

N73-24046 Service Technique Aeronautique, Paris (France).
THE ESTIMATION OF AERODYNAMIC COEFFICIENTS NECESSARY FOR PERFORMANCE CALCULATIONS c01
C. Lievens *In* AGARD Aircraft Performance: Prediction Methods and Optimization Mar. 1973 28 p In FRENCH (For availability see N73-24042 15-02)

Aerodynamic coefficients are used to study the performance of scale and wind tunnel models of transport aircraft. Data cover fuselage reactions, boundary layer evolution, and differences in results for the two models. Particular attention was given to the effects of boundary layer flow separation, boundary layer evolution, boundary layer reaction near flight and attack edge, and shock wave interaction with the boundary layer.
Transl. by E.H.W.

N73-24047 Service Technique Aeronautique, Paris (France).
AIRCRAFT MASS
C. Vivier and P. Cormier *In* AGARD Aircraft Performance: Prediction Methods and Optimization Mar. 1973 21 p In FRENCH (For availability see N73-24042 15-02)

A study was made of methods used to estimate aircraft mass and the effects of that mass on the aircraft performance.
Transl. by E.H.W.

N73-24048* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENGINE SELECTION FOR TRANSPORT AND COMBAT AIRCRAFT c28
James F. Dugan, Jr. *In* AGARD Aircraft Performance: Prediction Methods and Optimization Mar. 1973 55 p refs (For availability see N73-24042 15-02)
CSCL 21A

The procedures for selecting engines for transport and combat aircraft during the design process are presented. The types of aircraft considered are: (1) a long haul conventional takeoff and landing transport, (2) a short haul vertical takeoff and landing transport, (3) a long range supersonic transport, and (4) a fighter aircraft. The influence of aircraft noise considerations on engine selection is examined. The aerodynamic characteristics of supercritical wings and their effect on engine selection are reported. Author

N73-24049 Boeing Co., Seattle, Wash. Commercial Airplane Div.
PARAMETRIC AND OPTIMISATION TECHNIQUES FOR AIRPLANE DESIGN SYNTHESIS
Richard E. Wallace *In* AGARD Aircraft Performance: Prediction Methods and Optimization Mar. 1973 57 p refs (For availability see N73-24042 15-02)

Aircraft design synthesis for various conditions of performance and load carrying capacity is discussed. The subjects presented are: (1) parametric evaluation techniques, (2) optimiza-

tion evaluation techniques, and (3) computerized airplane design synthesis. Charts are developed to show the elements of synthesis, principal lines of data flow for aircraft design, propulsion parameters, aerodynamic parameters, and optimization methods. Author

N73-24050 Societe Nationale Industrielle Aerospatiale, Paris (France).
DISCREPANCY BETWEEN APPROVAL AND MODERNISM
G. Dumas *In* AGARD Aircraft Performance: Prediction Methods and Optimization Mar. 1973 3 p (For availability see N73-24042 15-02)

The characteristics of aircraft flight manuals and their formats for presentation of information are discussed. A specific example of the take-off performance chart is developed. Discrepancies in performance data which arise from different methods of compiling and computing the information are cited. A diagram of a typical takeoff chart to show the interrelationships of outside air temperature, flap setting, aircraft weight, speed ratio, runway slope, and wind velocity and their effect on takeoff distance is included. Author

N73-24051 Technische Hogeschool, Delft (Netherlands).
AN ANALYTICAL EXPRESSION FOR THE BALANCED FIELD LENGTH
E. Torenbeek *In* AGARD Aircraft Performance: Prediction Methods and Optization Mar. 1973 8 p refs (For availability see N73-24042 15-02)

A tractable analytical expression for the balanced field length of a civil aircraft to be used in parametric design studies is presented. It is demonstrated that in the project design stage, a detailed solution of the equations of motion and the graphical-numerical processes for the definition of the decision point can be avoided without serious loss of accuracy. Mathematical models are prepared to show the method for analyzing aircraft takeoff performance. Diagrams are included to show the phases of takeoff which influence the aircraft performance and forces exerted on the aircraft during the takeoff phases. Author

N73-24052 Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
SUPPLEMENTARY NOTE TO FLIGHT MANOEUVRE AND CLIMB PERFORMANCE PREDICTION
P. Foerster *In* AGARD Aircraft Performance: Prediction Methods and Optimization Mar. 1973 8 p (For availability see N73-24042 15-02)

A numerical analysis of the minimum time climbing procedure for aircraft is presented. The procedure is defined as the locus of all tangent points of the constant energy lines and the constant specific excess power lines on the performance chart. In a similar manner, the minimum fuel climbing procedure is defined by a locus of all tangent points of the constant energy maneuverability index lines and the constant specific energy lines. Specific application of the methods to a typical subsonic aircraft is analyzed. Author

N73-24053 Hawker Siddeley Aviation, Ltd., Brough (England).
MINIMUM TIME TRAJECTORY COMPUTATION: DEVELOPMENT OF THE BALAKRISHNAN METHOD
P. Middleton *In* AGARD Aircraft Performance: Prediction Methods and Optimization Mar. 1973 6 p ref (For availability see N73-24042 15-02)

The development of a computer program for determining minimum time trajectory for aircraft flight is discussed. In the method discussed, the state and control variables are considered at a number of discrete points and a path through the matrix of these values is computed for the solution. The gradient method of computation in which the equations of motion are integrated at each iteration is described. Mathematical models and graphs are included to support the theoretical considerations. Author

N73-24054 Royal Aircraft Establishment, Farnborough (England).
REVIEW OF TWO METHODS OF OPTIMIZING AIRCRAFT DESIGN
D. L. I. Kirkpatrick *In* AGARD Aircraft Performance: Prediction Methods and Optimization Mar. 1973 p 14 (For availability see N73-24042 15-02)

Two methods of optimizing aircraft design are discussed. One is an analytical method of optimizing three of the principal design variables of a subsonic swept wing jet transport aircraft and demonstrated how optimum design is affected by changes in mission requirements, operational constraints, and assumed design changes. The other method uses an aircraft design program coupled with the multivariate analysis technique to optimize 15 aircraft design variables using equations to represent the aerodynamic characteristics of the wing and high-lift devices, the masses of all the various aircraft components, and the engine performance. Author

N73-24055# Tampere Univ. of Technology, (Finland).
OPTIMAL DOLPHIN SOARING AS A VARIATIONAL PROBLEM
Risto Arho 1972 17 p refs
(ME-68; ISBN-951-666-016-9) Avail: NTIS HC $3.00

A technique for improving sailplane performance during cross country flight is described. The technique is called dolphin motion and consists of pulling up in lift and diving through down, with no thermal circling. The technique is especially effective in cloudstreet flying, enabling long distances to be covered in straight line flight. The problem of minimum flight time in dolphin soaring is discussed and the minium flight time problem is solved numerically by the calculus of variations. Author

N73-24056# National Aeronautical Lab., Bangalore (India).
THE EFFECT OF AERODYNAMIC LAG ON THE BENDING RESPONSE OF WINGS AT SUPERSONIC SPEEDS
B. R. Somashekar Nov. 1971 25 p refs
(NAL-TN-36) Avail: NTIS HC $3.25

The effect of aerodynamic lag on the bending response of wings in supersonic flow conditions is reported. The possibility of approximately representing the lag function by simple functions, which facilitate aeroelastic analysis, is examined. Laplace transform techniques are used for obtaining the response solution and the method is applicable to any Mach number. It is shown that the lag is important in response to calculations which may be used for estimating transient loads due to gusts or maneuvers. Author

N73-24057*# Teledyne Ryan Aeronautical Co., San Diego, Calif.
FEASIBILITY STUDY OF MODIFICATIONS TO BQM-34E DRONE FOR NASA RESEARCH APPLICATIONS
H. A. James 27 Dec. 1972 201 p refs
(Contract NAS1-11758)
(NASA-CR-112323; ASTM-72-40) Avail: NTIS HC $12.25 CSCL 01C

The feasibility of modifying an existing supersonic drone into a free-flight research vehicle is examined. Appropriate structural and control system modifications, reliability and operational considerations, and ROM costs indicate that the BQM-34E drone is indeed suitable as a NASA research vehicle. Author

N73-24058*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS OF A 55 DEG CLIPPED-DELTA-WING ORBITER MODEL AT MACH NUMBERS FROM 1.60 TO 4.63
A. B. Blair, Jr. and Josephine Grow Washington May 1973 96 p ref
(NASA-TM-X-2748; L-8732) Avail: NTIS HC $3.00 CSCL 01C

Wind tunnel tests to determine the supersonic aerodynamic characteristics of a delta wing space shuttle orbiter model were conducted. The model was tested at Mach numbers from 1.60 to 4.63, at nominal angles of attack from minus 2 degrees to plus 30 degrees, nominal sideslip angles of minus 4 degrees to plus 10 degrees, and Reynolds numbers from 1.8 to 2.5 times one million per foot. Author

N73-24059*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE TESTS OF A MIXER NOZZLE-EXTERNALLY BLOWN FLAP SYSTEM
Jack H. Goodykoontz, Robert G. Dorsch, and Donald E. Groesbeck Washington May 1973 56 p refs
(NASA-TN-D-7236; E-7288) Avail: NTIS HC $3.00 CSCL 01C

Noise tests were conducted on a large scale model of an externally blown flap lift augmentation system, employing a mixer nozzle. The mixer nozzle consisted of seven flow passages with a total equivalent diameter of 40 centimeters. With the flaps in the 30 - 60 deg setting, the noise level below the wing was less with the mixer nozzle than when a standard circular nozzle was used. At the 10 - 20 deg flap setting, the noise levels were about the same when either nozzle was used. With retracted flaps, the noise level was higher when the mixer nozzle was used. Author

N73-24060*# Scripta Technica, Inc., Washington, D.C.
FLIGHT OF AIRCRAFT WITH PARTIAL AND UNBALANCED THRUST
M. L. Gallay NASA Apr. 1973 176 p refs Transl. into ENGLISH of the book "Polet Samoleta s Nepolnoy i Nesimmetrichnoy Tyagoy" Moscow, Mashinostroyeniye Press, 1970
(Contract NASw-2036)
(NASA-TT-F-734) Avail: NTIS HC $3.00 CSCL 01C

The problem of aircraft operation under conditions of unbalanced thrust following the failure of an engine on a multi-engine aircraft is examined. The dynamics of the divergent motion of the aircraft immediately after engine failure are analyzed. Emphasis is placed on the condition of an engine located outside the plane of symmetry of the aircraft. The effects on the steady flight regime, execution of maneuvers, and pilot handling are investigated. Specific examples are included to clarify the theoretical considerations. Author

N73-24061*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
A MANUAL CONTROL THEORY ANALYSIS OF VERTICAL SITUATION DISPLAYS FOR STOL AIRCRAFT Final Report
Sheldon Baron and William H. Levison Apr. 1973 179 p refs
(Contract NAS2-6652)
(NASA-CR-114620; BBN-2484) Avail: NTIS HC $11.00 CSCL 01C

Pilot-vehicle-display systems theory is applied to the analysis of proposed vertical situation displays for manual control in approach-to-landing of a STOL aircraft. The effects of display variables on pilot workload and on total closed-loop system performance was calculated using an optimal-control model for the human operator. The steep approach of an augmentor wing jet STOL aircraft was analyzed. Both random turbulence and mean-wind shears were considered. Linearized perturbation equations were used to describe longitudinal and lateral dynamics of the aircraft. The basic display configuration was one that abstracted the essential status information (including glide-slope and localizer errors) of an EADI display. Proposed flight director displays for both longitudinal and lateral control were also investigated. Author

N73-24062*# Boeing Commercial Airplane Co., Seattle, Wash.
APPROACH PATH CONTROL FOR POWERED-LIFT STOL AIRCRAFT
D. J. Clymer and C. C. Flora Apr. 1973 100 p refs
(Contract NAS2-6344)
(NASA-CR-114574; D6-60222) Avail: NTIS HC $7.00 CSCL 01C

A flight control system concept is defined for approach flightpath control of an augmentor wing (or similar) powered-lift STOL configuration. The proposed STOL control concept produces aircraft transient and steady-state control responses that are familiar to pilots of conventional jet transports, and has potential for good handling qualities ratings in all approach and landing phases. The effects of trailing-edge rate limits, real-engine dynamics, and atmospheric turbulence are considered in the study. A general discussion of STOL handling qualities problems and piloting techniques is included. Author

N73-24063*# Boeing Co., Philadelphia, Pa. Vertol Div.
A COMPENDIUM OF STATIC AND CRUISE TEST RESULTS FROM A SERIES OF TESTS ON 13 FT DIAMETER LOW DISC LOADING ROTORS
Virgil H. Soule and R. D. Clark 27 Mar. 1973 138 p refs
(Contract NAS2-6784)
(NASA-CR-114625; D160-10021-1) Avail: NTIS HC $9.00 CSCL 01C

The results are presented of tests conducted on a series of 13 foot rotors with various blade twists during the time period from 1969 to 1972. The tests were accomplished at AFAPL Wright-Patterson Air Force Base, Ohio and the ONERA 8-meter tunnel at Modane, France. Both static and cruise performance data are presented. Author

N73-24064# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT, US CIVIL AVIATION
23 Mar. 1973 511 p
(NTSB-BA-73-2) Avail: NTIS HC $27.75

Selected aircraft accident reports concerning U.S. civil aviation accidents occurring during calendar year 1972 are presented. Reports are submitted on 894 accidents. The facts, conditions, circumstances, and probable cause for each accident are reported. Additional statistical information is tabulated by type of accident, phase of operation, kind of flying, injury index, aircraft damage, conditions of light, pilot certificate, injuries, and causal factors. Author

N73-24065*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPLICATION OF SONIC-BOOM MINIMIZATION CONCEPTS IN SUPERSONIC TRANSPORT DESIGN
Harry W. Carlson, Raymond L. Barger, and Robert J. Mack Washington Jun. 1973 59 p refs
(NASA-TN-D-7218; L-8767) Avail: NTIS HC $3.00 CSCL 20A

The applicability of sonic boom minimization concepts in the design of large supersonic transport airplanes capable of a 2500-nautical-mile range at a cruise Mach number of 2.7 is considered. Aerodynamics, weight and balance, and mission performance as well as sonic boom factors, have been taken into account. The results indicate that shock-strength nominal values of somewhat less than 48 newtons/sq m during cruise are within the realm of possibility. Because many of the design features are in direct contradiction to presently accepted design practices, further study of qualified airplane design teams is required to ascertain sonic boom shock strength levels actually attainable for practical supersonic transports. Author

N73-24066*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LONGITUDINAL AERODYNAMIC PARAMETERS OF THE KESTREL AIRCRAFT (XV-6A) EXTRACTED FROM FLIGHT DATA
William T. Suit and James L. Williams Washington Jun. 1973 42 p refs
(NASA-TN-D-7296; L-8703) Avail: NTIS HC $3.00 CSCL 01B

Flight-test data have been used to extract the longitudinal aerodynamic parameters of a vectored-thrust aircraft. The results show that deflecting the thrust past 15 has an effect on the pitching-moment derivatives and tends to reduce the static stability. The trend toward reduction in the longitudinal stability also been noted by the pilots conducting the flight tests. Author

N73-24067# General Accounting Office, Washington, D.C.
IN FLIGHT ESCAPE SYSTEMS FOR HELICOPTERS SHOULD BE DEVELOPED TO PREVENT FATALITIES Report to the Congress by the Comptroller General of the United States
Elmer B. Staats 12 Jun. 1973 33 p
(B-177166) Avail: NTIS HC $3.75

An investigation was conducted to determine the current status of escape systems for helicopter flight crews. The subjects discussed are: (1) need for helicopter in-flight escape systems, (2) development of capsule in-flight escape system, and (3) development of individual in-flight escape system. Author

N73-24068# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: TRANS WORLD AIRLINES, INCORPORATED, BOEING 707-331C, N788TW, JOHN F. KENNEDY INTERNATIONAL AIRPORT, JAMAICA, NEW YORK, 12 DECEMBER 1972

2 May 1973 14 p
(NTSB-AAR-73-11) Avail: NTIS HC $3.00

An aircraft accident involving a Boeing 707 aircraft during an instrument landing system approach to the John F. Kennedy International Airport, New York, on 12 December, 1972 is reported. The probable cause of the accident was determined as failure of the pilot to maintain a safe descent path by external reference during the landing approach. Author

N73-24069*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NUCLEAR AIR CUSHION VEHICLES

John L. Anderson 1973 39 p refs Presented at the Am. Ordnance Assoc., Washington, D. C., 8-9 May 1973
(NASA-TM-X-68231; E-7442) Avail: NTIS HC $4.00 CSCL 01C

The state-of-the-art of the still-conceptual nuclear air cushion vehicle, particularly the nuclear powerplant, is identified. Using mission studies and cost estimates, some of the advantages of nuclear power for large air cushion vehicles are described. The technology studies on mobile nuclear powerplants and conceptual ACV systems/missions studies are summarized. Author

N73-24070*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ENGINE-OVER-THE-WING NOISE RESEARCH

Meyer Reshotko, Jack H. Goodykoontz, and Robert G. Dorsch 1973 23 p refs Proposed for presentation at 6th Fluid and Plasma Dyn. Conf., Palm Springs, Calif., 16-18 Jul. 1973; sponsored by AIAA
(NASA-TM-X-68246; E-7429) Avail: NTIS HC $3.25 CSCL 20A

Acoustic measurements for large model engine-over-the-wing (EOW) research configurations having both conventional and powered lift applications were taken for flap positions typical of takeoff and approach and at locations simulating flyover and sideline. The results indicate that the noise is shielded by the wing and redirected above it, making the EOW concept a prime contender for quiet aircraft. The large-scale noise data are in agreement with earlier small-model results. Below the wing, the EOW configuration is about 10 PNdb quieter than the engine-under-the-wing externally-blown-flap for powered lift, and up to 10 db quieter than the nozzle alone at high frequencies for conventional lift applications. Author

N73-24071*# Stanford Univ., Calif. Guidance and Control Lab.

SYNTHESIS OF HOVER AUTOPILOTS FOR ROTARY-WING VTOL AIRCRAFT

W. E. Hall and Arthur E. Bryson, Jr. Jun. 1972 31 p refs
(Contract NAS2-5143)
(NASA-CR-132053; SUDAAR-446) Avail: NTIS HC$3.75 CSCL 01C

The practical situation is considered where imperfect information on only a few rotor and fuselage state variables is available. Filters are designed to estimate all the state variables from noisy measurements of fuselage pitch/roll angles and from noisy measurements of both fuselage and rotor pitch/roll angles. The mean square response of the vehicle to a very gusty, random wind is computed using various filter/controllers and is found to be quite satisfactory although, of course, not so good as when one has perfect information (idealized case). The second part of the report considers precision hover over a point on the ground. A vehicle model without rotor dynamics is used and feedback signals in position and integral of position error are added. The mean square response of the vehicle to a very gusty, random wind is computed, assuming perfect information feedback, and is found to be excellent. The integral error feedback gives zero position error for a steady wind, and smaller position error for a random wind. Author

N73-24072*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

GUIDANCE FOR A TILT ROTOR VTOL AIRCRAFT DURING TAKEOFF AND LANDING

Narendra K. Gupta and Arthur E. Bryson, Jr. Dec. 1972 116 p refs
(Contract NAS2-5143)
(NASA-CR-132043; SUDAAR-448) Avail: NTIS HC$8.00 CSCL 01C

A perturbation guidance scheme is developed to keep a tilt-rotor VTOL aircraft close to a predetermined nominal flight path during take-off and landing. A simulation of the guidance scheme applied to the Bell Model 266 tilt-rotor VTOL gave satisfactory behavior in the presence of initial errors and wind disturbances. Author

N73-24073# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

A PROBLEM DEFINITION FOR THE EJECTOR FLAP STOL CONCEPT

Thomas A. Durham, Jr. Jun. 1972 29 p refs
(AD-758202; ASD/XR-72-26) Avail: NTIS CSCL 01/3

The report addresses the application of cold thrust augmentation - i.e., the ejector flap - to the STOL requirement. The approach is to examine the results of a preliminary analysis in light of new information which was not originally considered. The original preliminary analysis, examined the potential of this concept by modifying an existing aircraft design to accept an ejector flap mechanism. It was found that in addition to an increase in STOL performance, the device could also yield performance gains by leaving the ejector flap on during other flight modes, i.e., climb, loiter and cruise. The optimum ejector geometry was in the low area ratio, low thrust augmentation ratio region. This latter finding was in direct contrast to other ejector efforts of current interest. The conclusion drawn is that this concept will probably yield most benefit for STOL missions requiring extended loitering of climbing time. Ejector on operation does not look promising for high speed cruise. (Author Modified Abstract) GRA

N73-24074# Lockheed-California Co., Burbank.

ENGINEERING CRITERIA AND ANALYSIS METHODOLOGY FOR THE APPRAISAL OF POTENTIAL FRACTURE RESISTANT PRIMARY AIRCRAFT STRUCTURE Final Report, 15 Feb. 1971 - 15 Aug. 1972

John C. Ekvall, Thomas R. Brusset, Alan F. Liu, and Matthew Creager Wright-Patterson AFB, Ohio AFFDL Sep. 1972 328 p refs
(Contract F33615-71-C-1324; AF Proj. 1467)
(AD-757870; LR-52388; AFFDL-TR-72-80) Avail: NTIS CSCL 01/3

Design criteria and analysis procedures are presented such that a design system can be implemented to minimize the occurrence of major structural failures due to the presence of undetected damage. The design criteria define a flaw growth durability requirement and crack growth structural integrity requirements for three classes of inspectability of the structure; noninspectable, NDI in-service inspectable, and walk-around inspectable. Currently available crack growth and residual strength methods of analysis are presented which can be used to predict the remaining life and strength of damaged structure. To illustrate the use of the criteria and methods of analysis, a design study was conducted of the lower wing surface of a fighter/attack aircraft. The results of this study indicate that the structure could meet the design criteria with little or no weight penalty using 7075-T76 aluminum and annealed Ti-6Al-4V, and provided adequate inspection techniques and inspection frequencies are applied throughout the life of the aircraft. Author (GRA)

N73-24075# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.

NONLINEAR INTERACTION OF PANEL FLUTTER WITH HARMONIC FORCING EXCITATION

Ching-Chiang Kuo, Luigi Morino, and John Dugundji Dec. 1972 46 p refs
(Contract F44620-69-C-0091; AF Proj. 9782)
(AD-758264; ASRL-TR-159-5; AFOSR-73-0536TR) Avail: NTIS CSCL 01/3

The interaction characteristics of harmonic forcing excitation and panel flutter are studied analytically. Both linear and nonlinear solutions are investigated. Wide ranges of dynamic pressure and forcing frequency are covered such that subcritical responses (pure forced response), supercritical responses (forcing-flutter interaction), and the coexistence of both pure forced response and forcing-flutter interaction are studied. Results obtained by

both harmonic balance and direct integration methods generally agree well. The technique developed here can be applied to other structural dynamics problems. Author (GRA)

N73-24076# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SELECTION OF OPTIMAL STABILITY AUGMENTATION SYSTEM PARAMETERS FOR A HIGH PERFORMANCE AIRCRAFT USING PITCH PAPER PILOT M.S. Thesis
Robert P. Denaro and Garrison L. Greenleaf 17 Oct. 1972 114 p refs
(AD-757879; GGC/EE/73-3) Avail: NTIS CSCL 01/3

Pitch paper pilot is a computer program which yields pilot parameters for a pitch tracking task and predicts the pilot rating of the aircraft handling qualities. Using Pitch Paper Pilot, optimal SAS gains are selected for the fixed form Stability Augmentation System of a high performance aircraft with structural bending. This aircraft was described in the Design Challenge to the 1970 Joint Automatic Control Conference. The final augmented aircraft responses compared favorably with desired normal acceleration response envelopes. The pilot model in Pitch Paper Pilot is modified in this study to include pilot lag and remnant which results in greater rating accuracy, although a few cases still show room for improvement. Author (GRA)

N73-24077# Decision Science, Inc., San Diego, Calif.
PRINCIPLES OF DISPLAY AND CONTROL DESIGN OF REMOTELY PILOTED VEHICLES Semiannual Technical Report
Lawrence J. Fogal, Robert S. Gill, Michael L. Mout, Douglas G. Hulett, and Carl E. Englund 14 Feb. 1973 156 p refs
(Contract N00014-72-C-0196; NR Proj. 196-119)
(AD-757761; SATR-2) Avail: NTIS CSCL 01/3

Review of potential RPV mission assignments and the peculiar problems of RPV flight control lead to a preliminary experiment wherein the performance of Navy attack pilots, model aircraft pilots, and engineer non-pilots was compared on a simulated scenario using eight different display/control configurations (inside-out vs. outside-in, attitude display, predictive vs. non-predictive attitude display and position vs. rate control stick). Navy pilots demonstrated significantly better performance; however, no significant difference was found between inside-out and outside-in display (although almost all subjects, including Navy pilots, preferred the outside-in presentation). Attitude prediction was not found to be of value, and position control stick was significantly superior to the conventional rate stick. The Embedded Figures Test appears to be a useful indicator of expected performance. Analysis revealed that additional information is required for manual flight control. Specific problems of sensor control, diagnosis of ECM impact, and usage of autopilot capability were identified. Suitable recommendations were identified. Suitable recommendations were made in this regard. Author (GRA)

N73-24078# Kaman Aircraft Corp., Bloomfield, Conn.
DESIGN STUDY OF EXPENDABLE MAIN ROTOR BLADES Final Report
Michael C. Frengley, Paul F. Maloney, and Carroll R. Akeley Oct. 1972 232 p refs
(Contract DAAJ02-71-C-0041; DA Proj. 1F1-62205-A-119)
(AD-758464; R-979; USAAMRDL-TR-72-48) Avail: NTIS CSCL 01/3

A design study is performed to determine the feasibility and cost advantages of expendable main rotor blades designed for the UH-1H helicopter. Technical feasibility, manufacturing cost, reliability, maintainability, and life-cycle costs were determined. Three concepts were projected to have life-cycle costs lower than those of the current blade. A blade of simplified all-aluminum construction is shown to have the lowest initial procurement cost, while one of stainless steel sheet and fiberglass has the lowest life-cycle cost. Author (GRA)

N73-24079# Bell Aerospace Co., Buffalo, N.Y.
A STUDY OF AIR CUSHION LANDING SYSTEMS FOR RECOVERY OF UNMANNED AIRCRAFT
John M. Ryken Wright-Patterson AFB, Ohio AFFDL Jul. 1972 141 p refs
(Contract F33615-72-C-1175; AF Proj. 1369)
(AD-758789; AFFDL-TR-72-87) Avail: NTIS CSCL 06/7

The report presents results of a concept feasibility and formulation study of Air Cushion Landing Systems for recovery of unmanned aircraft (Remotely Piloted Vehicles). A modified Ryan Model 147G drone or special purpose aircraft was investigated for possible use in a low cost flight test demonstration of air cushion landing gear concepts on an existing unmanned aircraft. Recovery by horizontal landing on an air cushion landing system is compared with recovery with a mid-air recovery system. Author (GRA)

N73-24080# Illinois Inst. of Tech., Chicago. Dept. of Mechanics, Mechanical and Aerospace Engineering.
V/STOL ORIENTED AERODYNAMIC STUDIES Progress Report, 1 Oct. 1971 - 30 Sep. 1972
Mark V. Morkovin, Z. Lavan, A. A. Fejer, H. M. Nagib, J. L. Way, and T. P. Torda Sep. 1972 60 p refs
(Contract F44620-69-C-0022; AF Proj. 9560; Proj. Themis)
(AD-758899; THEMIS-IIT-TR-R-72-9; AFOSR-73-0590TR) Avail: NTIS CSCL 01/3

Besides refinements of 71 results, the following advances are noteworthy. A modular approach to complex flow phenomena was developed and illustrated for flows around protuberances and for control of free-stream turbulence. A new, multiply linear and nonlinear mechanism of transition downstream of isolated roughness elements was documented in detail. The previously developed technique for high-Reynolds number simulation was applied to wind-tunnel simulation of atmospheric boundary layers. Adaption of a small water tunnel led to detailed comparisons of two-dimensional unsteady separation and stall phenomena over airfoils oscillating in pitch, airfoils with oscillating flaps, and inclined fixed airfoils in periodically surging streams. Response of flows with locally separated pockets to periodic modulation of the free stream was documented. (Author Modified Abstract) GRA

N73-24081# Naval Postgraduate School, Monterey, Calif.
THE DESIGN AND DEVELOPMENT OF A NON-FLAPPING ROTOR SYSTEM UTILIZING INFLEXIBLE BLADES AND EMPLOYING A NEW ROTOR CONTROL MECHANISM M.S. Thesis
William Alfred Simmons Dec. 1972 72 p refs
(AD-758514) Avail: NTIS CSCL 01/3

The intent of this study was the design, development and preliminary testing of an inflexible blade, hingeless rotor system. A hingeless system was desired due to its advantage of augmented control power resulting from its ability to transfer bending moments across the hub. The inflexible blades offered the unconventional feature of reducing the magnitude of blade flap-wise flexing to substantially zero and of removing the resultant problems of rotor dynamics. These stiffer blades generally dictated the use of more compact rotors, i.e., of a smaller diameter and therefore of a higher disk loading. The control rotor was of unconventional design and utilized a relatively small, free-flapping rotor to convey cyclic commands to the main rotor blades and provide rolling trim with varying forward speed. The present study has yielded a simple, mechanical system that essentially satisfies the design criteria and shows sufficient promise to warrant further development and testing. Author (GRA)

N73-24003 National Physical Lab., Teddington (England). Aerodynamics Div.
A STUDY OF THE EFFECT OF LEADING EDGE MODIFICATIONS ON THE FLOW OVER A 50-DEG SWEPTBACK WING AT TRANSONIC SPEEDS
E. W. E. Rogers, C. J. Berry, and J. E. G. Townsend *In* ARC Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 249-328 refs Supersedes ARC-21987 (For availability see N73-23995 15-01)
(ARC-R/M-3270; ARC-21987)

N73-24004 National Physical Lab., Teddington (England). Aerodynamics Div.
THE FLOW PATTERN ON A TAPERED SWEPTBACK WING AT MACH NUMBERS BETWEEN 0.6 AND 1.6, PART 1. EXPERIMENTS WITH A TAPERED SWEPTBACK WING OF WARREN 12 PLANFORM AT MACH NUMBERS BETWEEN 0.6 AND 1.6, PART 2
I. M. Hall and E. W. E. Rogers *In* ARC Res. Progr. on Aerodyn.

Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 329-487 refs Supersedes ARC-19691; ARC-22050 (For availability see N73-23995 15-01)
(ARC-R/M-3271; ARC-19691; ARC-22050)

N73-24005 Ministry of Aviation, London (England).
FREE FLIGHT MEASUREMENTS OF THE TRANSONIC ROLL DAMPING CHARACTERISTICS OF THREE RELATED WINGS OF ASPECT RATIO 2.83
K. J. Turner and G. K. Hunt *In* ARC Res. Progr. on Aerodyn. Heating Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 489-500 refs Supersedes RAE-TN-Aero-2683, ARC-22117 (For availability see N73-23995 15-01)
(ARC-R/M-3274; RAE-TN-Aero-2683; ARC-22117)

N73-24008 National Physical Lab., Teddington (England). Aerodynamics Div.
AN INVESTIGATION OF THE FLOW ABOUT A PLANE HALF WING OF CROPPED DELTA PLANFORM AND 6 PERCENT SYMMETRICAL SECTION AT STREAM MACH NUMBERS BETWEEN 0.8 AND 1.41
E. W. E. Rogers, I. M. Hall, and C. J. Berry *In* ARC Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 565-652 refs Supersedes ARC-22191 (For availability see N73-23995 15-01)
(ARC-R/M-3286; ARC-22191)

N73-24009 Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
EXPERIMENTS ON A DELTA WING WITH JET ASSISTED LIFT
W. H. Melbourne *In* ARC Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 653-700 refs Supersedes ARC-21968; Rept-101 (For availability see N73-23995 15-01)
(ARC-R/M-3288; ARC-21968; Rept-101)

N73-24018 Ministry of Aviation, London (England).
A NOTE ON FLUTTER OF ASYMMETRIC CONTROLS
E. G. Broadbent and E. V. Hartley *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 965-974 refs Previously issued as RAE-TN-STRUCT-278; ARC-22084 (For availability see N73-24011 15-01)
(ARC-R/M-3256; RAE-TN-STRUCT-278; ARC-22084)

N73-24022 Ministry of Aviation, London (England).
THE LONGITUDINAL STABILITY AND CONTROL OF THE TANDEM-ROTOR HELICOPTER, PART 1. THE LATERAL STABILITY AND CONTROL OF THE TANDEM-ROTOR HELICOPTER, PART 2
A. R. S. Bramwell *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1113-1211 refs Previously issued as RAE-NAVAL-3;ARC-21943;RAE-NAVAL-4; ARC-21918 (For availability see N73-24011 15-01)
(ARC-R/M-3223; RAE-NAVAL-3; ARC-21943; RAE-NAVAL-4; ARC-21918)

N73-24027 Ministry of Aviation, London (England).
FLIGHT TESTS TO INVESTIGATE THE DYNAMIC LATERAL-STABILITY CHARACTERISTICS OF A 45-DEG DELTA, CROPPED TO GIVE THREE ASPECT RATIOS
J. E. Nethaway and J. Clark *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1319-1335 refs Previously issued as RAE-TN-Aero-2671; ARC-21990 (For availability see N73-24011 15-01)
(ARC-R/M-3243; RAE-TN-Aero-2671; ARC-21990)

N73-24028 Aeronautical Research Council, London (England).
A THEORETICAL INVESTIGATION OF THE LONGITUDINAL STABILITY, CONTROL AND RESPONSE CHARACTERISTICS OF JET-FLAP AIRCRAFT, PARTS 1 AND 2
A. S. Taylor *In its* Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1337-1436 refs Previously issued as RAE-Aero-2600; RAE-TN-Aero-2670; ARC-19925; ARC-21867 (For availability see N73-24011 15-01)
(ARC-R/M-3272; RAE-Aero-2600; RAE-TN-Aero-2670; ARC-19925; ARC-21867)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N73-24082*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF 1 MeV ELECTRONS ON CERIA-DOPED SOLAR CELL COVER GLASS
Gilbert A. Haynes Washington May 1973 17 p refs
(NASA-TN-D-7245; L-8785) Avail: NTIS HC $3.00 CSCL 10A

The effect of 1 MeV electrons on the transmission properties of 1.5-percent ceria-doped solar cell cover glass was studied. Samples of doped and undoped cover glass and synthetic fused silica were irradiated with a total integrated flux of 10 to the 15th power e/sq cm. Wideband transmission and spectral transmission measurements were made before and after irradiation. The results indicate that 1.5-percent ceria-doped cover glass is much less sensitive to radiation induced discoloration than undoped cover glass. Consequently, the glass is comparable to synthetic fused silica when used as a radiation resistant solar cell cover for many space missions. Author

N73-24083*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MOLECULAR SOLID-STATE INVERTER-CONVERTER SYSTEM
Arthur G. Birchenough Washington May 1973 17 p refs
(NASA-TM-X-2795; E-7356) Avail: NTIS HC $3.00 CSCL 10A

A modular approach for aerospace electrical systems has been developed, using lightweight high efficiency pulse width modulation techniques. With the modular approach, a required system is obtained by paralleling modules. The modular system includes the inverters and converters, a paralleling system, and an automatic control and fault-sensing protection system with a visual annunciator. The output is 150 V dc, or a low distortion three phase sine wave at 120 V, 400 Hz. Input power is unregulated 56 V dc. Each module is rated 2.5 kW or 3.6 kVA at 0.7 power factor. Author

N73-24084*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONTROL AND PROTECTION SYSTEM FOR PARALLELED MODULAR STATIC INVERTER-CONVERTER SYSTEMS
Arthur G. Birchenough and Francis Gourash Washington May 1973 47 p refs
(NASA-TN-D-7279; E-7243) Avail: NTIS HC $3.00 CSCL 10A

A control and protection system was developed for use with a paralleled 2.5-kWe-per-module static inverter-converter system. The control and protection system senses internal and external fault parameters such as voltage, frequency, current, and paralleling current unbalance. A logic system controls contactors to isolate defective power conditioners or loads. The system sequences contactor operation to automatically control parallel operation, startup, and fault isolation. Transient overload protection and fault checking sequences are included. The operation and performance of a control and protection system, with detailed circuit descriptions, are presented. Author

N73-24085*# Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.
SOLAR ARRAY SYNTHESIS COMPUTER PROGRAM
T. J. Faith Apr. 1973 67 p refs
(Contract NAS5-21642)
(NASA-CR-130248) Avail: NTIS HC $5.50 CSCL 10A

Photovoltaic characteristics have been measured on solar

cells irradiated by 1 MeV electrons to fluences ranging from 1 x 10 to the 13th power e/sq cm to 1 x 10 to the 16th power e/sq cm, for cell temperatures ranging from 123 K to 473 K and for illumination intensities ranging from 5m W/sq cm to 1830m W/sq cm. Empirical equations have been derived from these measurements to describe the behavior of light generated current, open circuit voltage and I-V curve shape over various portions of these temperature/illumination ranges. Both 10 ohms/cm and 17 ohms/cm n-p silicon solar cells were tested, and similar analytical expressions were formulated for easy comparison between the two resistivities. Author

N73-24086*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF GAS-LUBRICATED NONCONFORMING PIVOTED-PAD JOURNAL BEARINGS AND A FLEXIBLY MOUNTED SPIRAL-GROOVE THRUST BEARING
Lloyd W. Ream Washington May 1973 28 p refs
(NASA-TM-X-2765; E-7269) Avail: NTIS HC $3.00 CSCL 13I

A test program was conducted to determine the performance characteristics of gas-lubricated nonconforming pivoted-pad journal bearings and a spiral-groove thrust bearing designed for the Brayton cycle rotating unit (BRU). Hydrostatic, hybrid (simultaneously hydrostatic and hydrodynamic), and hydrodynamic tests were conducted in argon gas at ambient pressure and temperature ranges representative of hydrostatic operation up to the 10.5-kWe BRU power-generating level. Performance of the gas lubricated bearings is presented, including hydrostatic gas flow rates, bearing clearances, bearing temperatures, and transient performance. Author

N73-24087*# Eagle-Picher Industries, Inc., Joplin, Mo. Couples Dept.
STUDY OF OXYGEN GAS PRODUCTION PHENOMENON DURING STAND AND DISCHARGE IN SILVER-ZINC BATTERIES Final Report
2 May 1973 94 p
(Contract NAS9-12032)
(NASA-CR-128933) Avail: NTIS HC $6.75 CSCL 10C

The effects of a number of cell process and performance variables upon the oxygen evolution rate of silver/silver oxide cathodes are studied to predict and measure the conditions which would result in the production of a minimum of oxygen. The following five tasks comprise the study: the design and fabrication of two pilot test cells to be used for electrode testing; the determination of the sensitivity and accuracy of the test cell; the determination of total volumes and rates of generation by cathodes of standard production procedures; the construction of a sequential test plan; and the construction of a series of positive formation cells in which formation process factors can be controlled. J.M.M.

N73-24088*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF ELECTRICAL SUBSYSTEM OF 2- TO 15-KILOWATT BRAYTON POWER CONVERSION SYSTEM
Richard R. Secunde and James E. Vrancik Washington Jun. 1973 25 p refs
(NASA-TM-X-2810; E-7366) Avail: NTIS HC $3.00 CSCL 10A

The electrical subsystem of the 2-to 15-kilowatt Brayton power conversion system was evaluated under various operating and off-design temperature conditions in a vacuum environment. Overall operation was satisfactory. Speed controller operation is a major cause of distortion in the system ac voltage and current waveforms. This distortion has a small, but potentially significant effect on the performance of individual subsystem components. Author

N73-24089*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTROMOTIVE FORCE MEASUREMENTS ON CELLS INVOLVING BETA-ALUMINA SOLID ELECTROLYTE
Nabendu Choudhury Washington Jun. 1973 18 p refs
(NASA-TN-D-7322; E-7291) Avail: NTIS HC $3.00 CSCL 10C

Open circuit emf measurements have been made to demonstrate that a two-phase, polycrystalline mixture of beta-alumina and alpha-alumina could be used as a solid electrolyte in galvanic cells with reversible electrodes fixing oxygen or aluminum chemical potentials. These measurements indicate that such a two phase solid electrolyte can be used to monitor oxygen chemical potentials as low as that corresponding to Al, Al2O3 coexistence. The activity of Na2O in beta-alumina in coexistence with alpha-alumina was also determined by emf measurements. Author

N73-24090*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PARAMETRIC PERFORMANCE CHARACTERISTICS AND TREATMENT OF TEMPERATURE COEFFICIENTS OF SILICON SOLAR CELLS FOR SPACE APPLICATION
R. E. Patterson and R. K. Yasui 15 May 1973 21 p refs
(Contract NAS7-100)
(NASA-CR-132156; JPL-TR-32-1582) Avail: NTIS HC $3.25 CSCL 10A

The electrical performance characteristics of 2 and 10 ohms-cm N/P-type silicon solar cells were measured at simulated solar intensities of 5, 50, 100, 140, 250, 400, 550, 700, and 850 mW/sq cm. At each intensity, the temperature was varied in increments of 20 deg between extremes of +160 and -160 C. Short-circuit current, open-circuit voltage, and maximum power are presented in graphical format. Also described are three methods for predicting solar cell electrical performance as a function of temperature and intensity. Two of the methods are suitable for use at extreme temperature-intensity conditions. These methods were used successfully to predict the performance of the transducer on board the Mariner Mars 1971 spacecraft. Author

N73-24091*# Stanford Univ., Calif. Dept. of Materials Science.
HEAT TREATMENT EFFECTS IN Cu2S-CdS HETEROJUNCTION PHOTOVOLTAIC CELLS Ph.D. Thesis
Alan L. Fahrenbruch May 1973 216 p refs
(Grant NGL-05-020-214)
(NASA-CR-121228) Avail: NTIS HC $13.00 CSCL 10A

The optical and electronic properties of single crystal Cu2S-CdS photovoltaic cells were investigated. In these cells trapped charge near the interface which is manifested by a persistent increase in junction capacitance (the photocapacitance) plays a significant role in determining the carrier transport properties. It was found that the severe degradation in short-circuit current observed in heat-treated cells can be separated into two components: (1) a relatively small thermal component occurring on heat-treatment in the dark, and (2) a much larger degradation caused by exposure to light at room temperature. By a short additional heat-treatment above approximately 100 C the cell can be completely restored to its condition before the optically caused degradation with no effect on the depletion layer width. Author

N73-24092# Los Alamos Scientific Lab., N.Mex.
SPACE ELECTRIC POWER R AND D PROGRAM Quarterly Report, period ending 31 Oct. 1972
Nov. 1972 28 p refs
(Contract W-7405-eng-36)
(LA-5113) Avail: NTIS

Developments in the thermionic reactor development program are reported. Major efforts were the gathering of post-irradiation data on ceramic specimens and bonded ceramic-metal trilayers; fabrication of prototype ceramic-metal trilayers and pentalayers for future neutron irradiation testing; planning, preliminary design, and initiation of a fast neutron spectrum, thermionic reactor critical experiment; and design and thermal analysis of two fueled-emitter irradiation capsules. Also reported are the effect of voltage at temperature on the electrical resistance of yttria-niobium trilayers; the performance testing of isothermal irradiator capsules; the development of W-UO2 cermets with high volume fractions of UO2; the thermal testing of fueled emitter configurations; and the results of electron microprobe analyses of irradiated thermionic fuel rod components. Author (NSA)

N73-24093# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
HYSTERESIS SYNCHRONOUS MOTOR. OPERATIONAL

THEORY [LE MOTEUR SYNCHRONE A HYSTERESIS. THEORIE DU FONCTIONNEMENT]
6 Feb. 1973 63 p refs In FRENCH
(LRBA-E-603-NT-1/SIE) Avail: NTIS HC $5.25

The theoretical characteristics of a hysteretic synchronous motor are presented. Some generalities on rotating fields are reviewed and an equivalent motor scheme is established based on the Maxwell equations and the ellipsoidal hysteresis cycle. The paralelpiped hysteresis cycle and a second harmonic approximation are used later to give a qualitative interpretation of the operation of a hysteretic synchronous motor. ESRO

N73-24094# Atomics International, Canoga Park, Calif.
NEW CATHODE MATERIAL FOR HIGH ENERGY-DENSITY BATTERIES
Margie M. Nicholson 30 Jan. 1973 32 p refs
(Contract F19628-72-C-0147; AF Proj. 8659)
(AD-757883; AI-72-59; AFCRL-72-0605; SR-1) Avail: NTIS CSCL 10/3

Semiconductive metal halides are under investigation as cathode materials for ambient-temperature lithium cells. N-type cadmium fluoride and zinc fluoride were further characterized as electrodes limited by cathodic passivation in a lithium perchlorate-propylene carbonate electrolyte. The discharge of cadmium fluoride occurred without passivation, however, in a tetramethylammonium hexafluorophosphate solution in the same solvent. The result confirms previous evidence that an alkali metal fluoride film was the cause of passivation in the case of cadmium fluoride and shows that the use of this material can be greatly increased by the elimination of alkali metal ions from the electrolyte. Zinc fluoride did not show a corresponding improvement. Performance estimates for porous cadmium fluoride cathodes indicate that the Li-CdF2(n-type) cell in TMA:PF6-PC may be superior to other organic-electrolyte systems where high power densities are required. Author (GRA)

N73-24095# Union Carbide Corp., Cleveland, Ohio. Consumer Products Div.
LOW COST OXYGEN ELECTRODES Interim Report, 11 May 1971 - 30 Jul. 1972
K. V. Kordesch and R. F. Scarr Jul. 1972 96 p refs
(Contract DAAK02-71-C-0297; DA Proj. 1T6-11102-A-34A)
(AD-758179; IR-2) Avail: NTIS CSCL 10/2

The purpose of the contract is the development of a low cost air electrode for medium temperature (130C) immobilized phosphoric acid (matrix) fuel cell. Thin carbon electrode structures were to be fabricated and catalyzed with the minimum amount of platinum which produced a H2-air cell performance of 0.6 volt cell terminal voltage (0.65 volt versus H2 reference) at 80 mA/sq cm, after 500 hours operation. By using special techniques of electrode manufacturing and catalyst application, a reduction of the Pt amount to a level of 1 to 2 mg Pt/sq cm was accomplished. Long-term testing of these electrodes has shown that the chemical and mechanical stability of the catalyst and structural material are good. X-ray fluorescence was used to determine the distribution and the amount of catalyst actually deposited. (Author Modified Abstract) GRA

N73-24096# American Univ., Washington, D.C.
RESEARCH ON ELECTROCHEMICAL ENERGY CONVERSION SYSTEMS Interim Technical Progress Report, Apr. - Oct. 1972
Alane A. Adams and Robert T. Foley Feb. 1973 55 p refs
(Contract DAAK01-72-C-0084; DA Proj. 1T0-61102-A-34A)
(AD-758180; ITPR-2) Avail: NTIS CSCL 10/2

The research on electrochemical energy conversion systems has involved work on two tasks: A search for electrolytes alternative to phosphoric acid for direct and indirect hydrocarbon-air fuel cells; and a study of the corrosion characteristics of electrolytes for intermediate-temperature hydrocarbon-air fuel cells. In the search for alternate electrolytes the techniques and equipment to evaluate the oxidation of propane were assembled and modified. Preliminary results were obtained which, in general, confirm previously reported results. These include the data on steady-state adsorption of propane from phosphoric acid and the extent of surface coverage as a function of time and potential. It is intended that these data will become a bench mark for future work with other alternative electrolytes. Corrosion tests of several alloys were performed at 150C and 175C in 85% phosphoric acid. Tantalum coated steel was essentially immune to corrosion and should be a desirable construction material for this type of service. Author (GRA)

N73-24097# Naval Ordnance Lab., White Oak, Md.
PREPARATION AND PURIFICATION OF FLINAK
G. L. Green, J. B. Hunt, and R. A. Sutula 23 Feb. 1973 16 p refs
(AD-758001; NOLTR-72-245) Avail: NTIS CSCL 07/2

The report describes a technique for preparing and purifying the fluoride salt eutectic of LiF, NaF, and KF (Flinak) which has been proposed for use as the electrolyte in a thermal battery system. The method involves the use of bromine pentafluoride, BrF5, to react with and to remove water and oxide impurities in the Flinak. Quantitative analysis of Flinak samples purified in this manner was performed, and the results are compared to those obtained by other currently employed purification techniques. Author (GRA)

N73-24098# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTERNATIONAL CONFERENCE ON THERMIONIC ELECTRICAL POWER GENERATION (3RD) (COLLECTION OF REPORTS)
26 Dec. 1972 353 p refs Transl. into ENGLISH of Proc. of Conf. held at Juelich, West Germany, 5 Jun. 1972
(AD-758620; FTD-MT-24-1419-72) Avail: NTIS CSCL 10/2

The document contains 24 papers. GRA

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N73-24099*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 113, MARCH 1973
Mar. 1973 99 p refs
(NASA-SP-7011(113)) Avail: NTIS HC $3.00 CSCL 06E

This special bibliography lists 321 reports articles, and other documents introduced into the NASA scientific and technical information system in February 1973. Author

N73-24100*+ National Aeronautics and Space Administration, Washington, D.C.
A CUMULATIVE INDEX TO THE 1972 ISSUES OF A CONTINUING BIBLIOGRAPHY ON AEROSPACE MEDICINE AND BIOLOGY
Jan. 1973 681 p refs
(NASA-SP-7011(111)) Avail: NTIS HC $9.00 CSCL 06E

This publication is a cumulative index to the abstracts contained in Supplements 99 through 110 of Aerospace Medicine and Biology: A Continuing Bibliography. It includes three indexes - subject, personal author, and corporate source. Author

N73-24101 National Lending Library for Science and Technology, Boston Spa (England).
VOICE AND HEARING IN THE SYSTEM OF ACOUSTIC ORIENTATION OF ANIMALS
V. D. Ilichev 12 Mar. 1973 24 p refs Transl. into ENGLISH from Zh. Obshch. Biol. (USSR), v. 32, no. 3, 1971 p 299-311
(NLL-DRIC-Trans-3056-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The general rules determining the interrelation of acoustic systems in various systematic groups and at various levels of evolution were examined. Functional characteristics of hearing and voice and the interrelation between them reveal clear changes in the following directions: (1) in the sphere of sound communication, more and more vital situations are involved, (2) the functional (dynamic) range is widened, and (3) the acoustic systems are universalized and their numbers are decreased. The interrelations

of the voice and hearing are considered as a biological correlation of a special type, guaranteeing organismic, populational and biocenotic channels of interrelation. Author

N73-24102*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PROCEEDINGS OF THE MICROBIAL RESPONSE TO SPACE ENVIRONMENT SYMPOSIUM
Gerald R. Taylor, ed. May 1973 192 p refs Symp. held at Houston, Tex., Sep. 1972
(NASA-TM-X-58103; MSC-07856) Avail: NTIS HC $11.75
CSCL 06M

The synergistic relationships between microbial genetic alterations and space flight conditions are studied in laboratory space environment simulations and Apollo 16 flight experiment packages. For individual titles, see N73-24103 through N73-24115.

N73-24103* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
BACKGROUND AND GENERAL DESIGN OF THE MICROBIAL RESPONSE TO SPACE ENVIRONMENT EXPERIMENT (M191) SYSTEM
Gerald R. Taylor *In its* Proc. of the Microbial Response to Space Environ. Symp. May 1973 p 3-19 refs (For availability see N73-24102 15-04)
CSCL 06M

Nine different species of organisms were exposed to space flight conditions during the Apollo 16 mission. Each test system was selected because it provided a quantitative method of evaluating some medically important phenomenon. The experiment design and each of the test systems are discussed. Author

N73-24104* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DESCRIPTION OF THE MICROBIAL ECOLOGY EVALUATION DEVICE, FLIGHT EQUIPMENT, AND GROUND TRANSPORTER c14
Charles E. Chassay and Gerald R. Taylor *In its* Proc. of the Microbial Response to Space Environ. Symp. May 1973 p 21-39 (For availability see N73-24102 15-04)
CSCL 06M

Exposure of test systems in space required the fabrication of specialized hardware termed a Microbial Ecology Evaluation Device that had individual test chambers and a complex optical filter system. The characteristics of this device and the manner in which it was deployed in space are described. Author

N73-24105* Northrop Services, Inc., Houston, Tex.
CUVETTE LOADING AND UNLOADING PROCEDURES c14
Carolyn Carmichael and Walter L. Ellis *In* NASA. Johnson Space Center Proc. of the Microbial Response to Space Environ. Symp. May 1973 p 41-48 (For availability see N73-24102 15-04)
CSCL 14B

The cuvettes for the flight hardware used in the Microbial Response to Space Environment Experiment (M191) were loaded with the biological test systems according to the methods described. After the flight, the experiment package was returned and dismantled. Then, the individual cuvettes were removed from the hardware and unloaded according to the procedures described. Author

N73-24106* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
INFECTIVITY AND EGG PRODUCTION OF NEMATOSPIROIDES DUBIUS AS AFFECTED BY SPACE FLIGHT AND ULTRAVIOLET IRRADIATION
Richard A. Long (Northrop Serv., Inc., Houston, Tex.), Walter L. Ellis (Northrop Serv., Inc., Houston, Tex.), and Gerald R. Taylor *In its* Proc. of the Microbial Response to Space Environ. Symp. May 1973 p 51-64 refs (For availability see N73-24102 15-04)
CSCL 06M

Nematospiroides dubius was tested to determine the infective potential of the third stage larvae and the egg-production and egg-viability rates of the resulting adults after they are exposed to space flight and solar ultraviolet irradiation. The results are indicative that space-flown larvae exposed to solar ultraviolet irradiation were rendered noninfective in C57 mice, whereas flight control larvae that received no solar ultraviolet irradiation matured at the same rate as the ground control larvae. However, depressed egg viability was evident in the flight control larvae. Author

N73-24107* Scripps Clinic and Research Foundation, La Jolla, Calif.
EFFECTS OF SPACE ENVIRONMENT ON T-7 BACTERIOPHAGE AND SPORES OF BACILLUS SUBTILIS 168
John Spizizen and James E. Isherwood *In* NASA. Johnson Space Center Proc. of the Microbial Response to Space Environ. Symp. May 1973 p 65-85 ref (For availability see N73-24102 15-04)
CSCL 06M

Two strains of Bacillus subtilis were exposed to components of the ultraviolet spectrum in space. Both strains possess multiple genetic markers, and one of the strains is defective in the ability to repair ultraviolet damage. The T-7 bacteriophage of Escherichia coli was also exposed to selected wavelengths and energy levels of ultraviolet light in space. Preliminary findings do not reveal anomalies in survival rates. Data are not yet available on detailed genetic analyses. Author

N73-24108* Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany).
EFFECTS OF SPACE VACUUM AND SOLAR ULTRAVIOLET IRRADIATION (254 NANOMETERS) ON THE COLONY FORMING ABILITY OF BACILLUS SUBTILIS SPORES
Horst Buecker, Gerda Horneck, and Helga Wollenhaupt *In* NASA. Johnson Space Center Proc. of the Microbial Response to Space Environ. Symp. May 1973 p 87-103 refs (For availability see N73-24102 15-04)
CSCL 06M

Bacillus subtilis spores are highly resistant to harsh environments. Therefore, in the Apollo 16 Microbial Response to Space Environment Experiment (M191), these spores were exposed to space vacuum or solar ultraviolet irradiation, or both, to estimate the change of survival for terrestrial organisms in space. The survival of the spores was determined in terms of colony-forming ability. Comparison of the flight results with results of simulation experiments on earth applying high vacuum or ultraviolet irradiation, or both, revealed no remarkable difference. Simultaneous exposure to both these space factors resulted in a synergistic effect (that is, an ultraviolet supersensitivity). Therefore, the change of survival in space is assumed to depend on the degree of protection against solar ultraviolet irradiation. Author

N73-24109* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
POSTFLIGHT ANALYSES OF BACILLUS THURINGIENSIS ORGANISMS EXPOSED TO SPACE FLIGHT CONDITIONS
R. T. Wrenn (Northrop Serv., Inc., Houston, Tex.), R. C. Simmonds, and A. M. Heimpel (Agr. Dept., Beltsville, Md.) *In its* Proc. of the Microbial Response to Space Environ. Symp. May 1973 p 105-120 refs (For availability see N73-24102 15-04)
CSCL 06M

Cultures of B. thuringiensis returned from space flight appeared to be normal to slightly affected adversely in their ability to produce three toxins that affect insects. In addition, it can be stated that B. thuringiensis spores are very resistant to ultraviolet irradiation at the individual wavelengths and energy levels previously described. Full sunlight, however, does have a detrimental effect on the viability of B. thuringiensis spores. Author

N73-24110* Eastern Michigan Univ., Ypsilanti, Mich.
MYCOLOGICAL STUDIES HOUSED IN THE APOLLO 16 MICROBIAL ECOLOGY EVALUATION DEVICE
Paul A. Volz *In* NASA. Johnson Space Center Proc. of the Microbial Response to Space Environ. Symp. May 1973 p 121-135 refs (For availability see N73-24102 15-04)
CSCL 06M

Survival, death, and phenotype count have yielded variation in the number of fungi recovered from the controls and the flight exposed cuvettes during preliminary analysis of postflight first phase data. Also the preliminary analysis was indicative

that fungi exposed to specific space flight conditions demonstrated variable survival rates and phenotype counts. Specific space flight conditions included full light space exposure for Chaetomium globosum, exposure at 300- and 254-nanometer wavelengths for Rhodotorula rubra, full light and 280-nanometer wavelength exposure for Trichophyton terrestre, and 254-nanometer wavelength exposure for Saccharomyces cerevisiae. In general, phenotype counts for flight cuvettes and survival rates for control cuvettes were higher compared with the remaining cuvettes.
Author

N73-24111* Texas A&M Univ., College Station.
EFFECT OF SOLAR IRRADIATION ON EXTRACELLULAR ENZYMES OF AEROMONAS PROTEOLYTICA
Bill G. Foster *In* NASA. Johnson Space Center Proc. of the Microbial Response to Space Environ. Symp. May 1973 p 137-151 refs (For availability see N73-24102 15-04)
CSCL 06M

The bacterium Aeromonas proteolytica was selected for studying the effects of solar irradiation on extracellular enzymes because it produces an endopeptidase that is capable of degrading proteins and a hemolysin that is active in lysing human erythrocytes. Possible alterations in the rate of enzyme production in response to the test conditions are currently underway and are not available for this preliminary report. Completed viability studies are indicative that little difference exists among the survival curves derived for cells exposed to various components of ultraviolet irradiation in space.
Author

N73-24112* Northrop Services, Inc., Houston, Tex.
THE USE OF FILM ACTINOMETRY IN LOW INTENSITY ULTRAVIOLET IRRADIATION MEASUREMENT c14
Richard A. Long *In* NASA. Johnson Space Center Proc. of the Microbial Response to Space Environ. Symp. May 1973 p 155-168 (For availability see N73-24102 15-04)
CSCL 14B

High resolution film was used to measure solar ultraviolet irradiation at a wavelength of 254 nanometers between energy levels of 3 x 10 to the minus 7 power and 130 x 10 to the minus 7 power joules (3 and 130 ergs). The results imply that the film recorded exposure to energy levels from 2.5 to 13 times the expected values. These high values are being evaluated for the influences of other factors that could affect the recorded values.
Author

N73-24113* Northrop Services, Inc., Houston, Tex.
THE FERRIOXALATE ACTINOMETRY SYSTEM OF THE MICROBIAL RESPONSE TO SPACE ENVIRONMENT EXPERIMENT (M191)
Michael Parson *In* NASA. Johnson Space Center Proc. of the Microbial Response to Space Environ. Symp. May 1973 p 169-178 refs (For availability see N73-24102 15-04)
CSCL 06M

The fluid actinometry portion of the Microbial Response to Space Environment Experiment (M191) was designed for measurement of the solar energy that penetrates certain optical filter systems during exposure in space. Potassium ferrioxalate was used to measure energy at peak wavelengths of 254, 280, and 300 nanometers because of its high degree of sensitivity and its linear response to the middle ultraviolet regions. Author

N73-24114* San Francisco Univ., Calif.
THE HIGH ENERGY MULTICHARGED PARTICLE EXPOSURE OF THE MICROBIAL ECOLOGY EVALUATION DEVICE ON BOARD THE APOLLO 16 SPACECRAFT
Eugene V. Benton and Richard P. Henke *In* NASA. Johnson Space Center Proc. of the Microbial Response to Space Environ. Symp. May 1973 p 179-189 refs (For availability see N73-24102 15-04)
CSCL 06M

The high energy multicharged cosmic-ray-particle exposure of the Microbial Ecology Evaluation Device package on board the Apollo 16 spacecraft was monitored using cellulose nitrate, Lexan polycarbonate, nuclear emulsion, and silver chloride crystal nuclear-track detectors. The results of the analysis of these detectors include the measured particle fluences, the linear energy transfer spectra, and the integral atomic number spectrum of stopping particle density. The linear energy transfer spectrum is used to compute the fractional cell loss in human kidney (T1) cells caused by heavy particles. Because the Microbial Ecology Evaluation Device was better shielded, the high-energy multicharged particle exposure was less than that measured on the crew passive dosimeters.
Author

N73-24115* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THERMOLUMINESCENT DOSIMETRY FOR THE APOLLO 16 MICROBIAL RESPONSE TO SPACE ENVIRONMENT EXPERIMENT (M191)
Robert D. Brown (Kelsey-Seybold Clinic), Robert A. English (Kelsey-Seybold Clinic), and J. Vernon Bailey *In its* Proc. of the Microbial Response to Space Environ. Symp. May 1973 p 191-197 refs (For availability see N73-24102 15-04)
CSCL 06M

Lithium fluoride thermoluminescent chips were used to provide an integrated dose from the broad spectrum of ionizing radiation to the Microbial Response to Space Environment Experiment (M191). The chips were positioned in the flight hardware to provide data on ionizing radiation within specific volume segments. A uniform radiation dose of 4.8 x 0.001 plus or minus 2 x 0.0001 joule/kg resulted.
Author

N73-24116*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
QUARANTINE CONSTRAINTS AS APPLIED TO SATELLITES
A. R. Hoffman, W. Stavro, and C. C. Gonzalez Jun. 1973 15 p ref Presented at the Joint Open Meeting of the Panel on Planetary Quarantine and Working Group 5, 16th Plenary Meeting of COSPAR, Konstanz, West Germany, 23 May - 6 Jun. 1973
(Contract NAS7-100)
(NASA-CR-132073; JPL-Paper-I.7.9) Avail: NTIS HC $3.00
CSCL 06M

Plans for unmanned missions to planets beyond Mars in the 1970s include satellite encounters. Recently published observations of data for Titan, a satellite of Saturn, indicate that conditions may be hospitable for the growth of microorganisms. Therefore, the problem of satisfying possible quarantine constraints for outer planet satellites was investigated. This involved determining the probability of impacting a satellite of Jupiter or Saturn by a spacecraft for a planned satellite encounter during an outer planet mission. Mathematical procedures were formulated which determine the areas in the aim-plane that would result in trajectories that impact the satellite and provide a technique for numerically integrating the navigation error function over the impact area to obtain impact probabilities. The results indicate which of the planned spacecraft trajectory correction maneuvers are most critical in terms of satellite quarantine violation.
Author

N73-24117*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT MICROBIAL BURDEN REDUCTION DUE TO ATMOSPHERIC ENTRY HEATING: JUPITER
C. C. Gonzalez, W. Jaworski, A. S. McRonald, and A. R. Hoffman Jun. 1973 15 p refs Presented at the Joint Open Meeting of the Panel on Planetary Quarantine and Working Group 5, 16th Plenary Meeting of COSPAR, Konstanz, West Germany, 23 May - 6 Jun. 1973
(Contract NAS7-100)
(NASA-CR-132072; JPL-Paper-I.7.8) Avail: NTIS HC $3.00
CSCL 06M

Planetary quarantine analyses performed for recent unmanned Mars and Venus missions assumed that the probability of contamination by a spacecraft given accidental impact was equivalent to one. However, in the case of the gaseous outer planets, the heat generated during the inadvertent entry of a spacecraft into the planetary atmosphere might be sufficient to cause significant microbial burden reduction. This could affect navigation strategy by reducing the necessity for biasing the aim point away from the planets. An effort has been underway to develop the tools necessary to predict temperature histories for a typical spacecraft during inadvertent entry. In order that the results have general applicability, parametric analyses were performed. The thermal response of the spacecraft components and debris resulting from disintegration was determined. The temperature histories of small particles and composite materials, such as thermal blankets and an antenna, were given special attention. Guidelines are given to indicate the types of components

and debris most likely to contain viable organisms, which could contaminate the lower layers of the Jovian atmosphere approximately one atmosphere of pressure). Author

N73-24118*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TERRESTRIAL QUARANTINE CONSIDERATIONS FOR UNMANNED SAMPLE RETURN MISSIONS
A. R. Hoffman, W. Stavro, L. W. Miller, and D. M. Taylor Jun. 1973 15 p refs Presented at the Joint Open Meeting of the Panel on Planetary Quarantine and Working Group 5, 16th Plenary Meeting of COSPAR, Konstanz, West Germany, 23 May - 6 Jun. 1973
(Contract NAS7-100)
(NASA-CR-132071; JPL-Paper-I.7.7) Avail: NTIS HC $3.00 CSCL 06M

For the purpose of understanding some of the possible implications of a terrestrial quarantine constraint on a mission and for developing a basic approach which can be used to demonstrate compliance beyond that developed for Apollo, a terrestrial quarantine study was performed. It is shown that some of the basic tools developed and used by the planetary quarantine community have applicability to terrestrial quarantine analysis. By using these tools, it is concluded that: (1) the method of biasing the earth aiming point when returning from the planet is necessary but, by itself, may not satisfy terrestrial quarantine constraints; and (2) spacecraft and container design significantly influence contamination transfer. Author

N73-24119*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
SPECTRA OF NORMAL AND NUTRIENT-DEFICIENT MAIZE LEAVES
A. H. Al-Abbas, R. Barr, J. D. Hall, F. L. Crane, and M. F. Baumgardner 1973 19 p refs
(Grant NGL-15-005-112; Contract USDA-12-14-100-10292-(20); Grant NSF GB-5701; K6-21839; GM-01392)
GM-01392)
(NASA-CR-132145; J-Paper-4839; LARS-111472) Avail: NTIS HC $3.00 CSCL 02A

Reflectance, transmittance and absorptance spectra of normal and six types of nutrient-deficient (N, P, K, S, Mg, and Ca) maize (Zea mays L.) leaves were analyzed at 30 selected wavelengths from 500 to 2600 nm. The analysis of variance showed significant differences in reflectance, transmittance and absorptance in the visible wavelengths among leaf numbers 3, 4, and 5, among the seven treatments, and among the interactions of leaf number and treatments. In the infrared wavelengths only treatments produced significant differences. The chlorophyll content of leaves was reduced in all nutrient-deficient treatments. Percent moisture was increased in S-, Mg-, and N-deficiencies. Polynomial regression analysis of leaf thickness and leaf moisture content showed that these two variables were significantly and directly related. Leaves from the P- and Ca-deficient plants absorbed less energy in the near infrared than the normal plants; S-, Mg-, K-, and N-deficient leaves absorbed more than the normal. Both S- and N-deficient leaves had higher temperatues than normal maize leaves. Author

N73-24120# Joint Publications Research Service, Arlington, Va.
CRYOBIOLOGICAL STUDIES AND SPACE BIOLOGY PROBLEMS
L. K. Lozina-Lozinskiy 25 May 1973 28 p Transl. into ENGLISH from Ocherki po Kriobiologii (Leningrad), 1972 p 238-260
(JPRS-59129) Avail: NTIS HC $3.50

Cryobiological and space biological studies reported consider: temperature conditions beyond earth, anaerobic metabolism and cold tolerance, atmospheric pressure effects on cells and organisms at low temperatures, effects of radiation at low and ultralow temperatures, and effect of ionizing radiation on organism in frozen state. G.G.

N73-24121*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOUDNESS FUNCTION DERIVES FROM DATA ON ELECTRICAL DISCHARGE RATES IN AUDITORY NERVE FIBERS
Walton L. Howes Washington Jun. 1973 32 p refs
(NASA-TN-D-7297; E-7101) Avail: NTIS HC $3.00 CSCL 06S

Judgments of the loudness of pure-tone sound stimuli yield a loudness function which relates perceived loudness to stimulus amplitude. A loudness function is derived from physical evidence alone without regard to human judgments. The resultant loudness function is $L = K(q-q0)$, where L is loudness, q is effective sound pressure (specifically q0 at the loudness threshold), and K is generally a weak function of the number of stimulated auditory nerve fibers. The predicted function is in agreement with loudness judgment data reported by Warren, which imply that, in the suprathreshold loudness regime, decreasing the sound-pressure level by 6 db results in halving the loudness. Author

N73-24122*# Houston Univ., Tex.
DEVELOPMENT OF GERM-FREE PLANTS AND TISSUE CULTURE Final Report
S. Venketeswaran Feb. 1973 191 p refs
(Contract NAS9-10947)
(NASA-CR-128947) Avail: NTIS HC $11.75 CSCL 06C

The botanical program is reported for experiments performed at the Lunar Receiving Laboratory. Papers prepared during this program are listed. The studies reported include: tissues cultured on various mediums, nutritional studies, preparation of plant cultures for Apollo 15, and pine tissue cultures. F.O.S.

N73-24123*# Linguistic Systems, Inc., Cambridge, Mass.
THE USE OF ULTRA-FINE FIBER FILTER CLOTH FOR REMOVING BACTERIAL CONTAMINANTS FROM THE AIR
G. I. Podoprigora and M. M. Intizarov Washington NASA Jun. 1973 4 p Transl. into ENGLISH from Zh. Mikrobiol. Epidemiol. i Immunobiol. (Moscow), 1972 p 130-131
(Contract NASw-2482)
(NASA-TT-F-14940) Avail: NTIS HC $3.00 CSCL 06M

Tests are described of a Russian domestically produced cloth with a fiber diameter of 0.5 to 1 micron. The test results indicate that the cloth is an effective filter material for gnotobiology and other scientific projects where bacterial contaminants must be removed from the air. Author

N73-24124*# Indiana State Univ., Terre Haute. Center for Neural Sciences.
INVESTIGATION OF THE NEUROLOGICAL CORRELATES OF INFORMATION RECEPTION Final Report, 1 Jan. 1965 - 31 Dec. 1971
31 Dec. 1971 28 p refs
(Grant NGR-15-003-007)
(NASA-CR-132047) Avail: NTIS HC #3.50 CSCL 06C

Animals trained to respond to a given pattern of electrical stimuli applied to pathways or centers of the auditory nervous system respond also to certain patterns of acoustic stimuli without additional training. Likewise, only certain electrical stimuli elicit responses after training to a given acoustic signal. In most instances, if a response has been learned to a given electrical stimulus applied to one center of the auditory nervous system, the same stimulus applied to another auditory center at either a higher or lower level will also elicit the response. This kind of transfer of response does not take place when a stimulus is applied through electrodes implanted in neural tissue outside of the auditory system. Author

N73-24125# School of Aerospace Medicine, Brooks AFB, Tex.
EFFECTS OF HYPEROXIA ON HEME BIOSYNTHESIS Summary Report, 15 Aug. 1971 - 30 Apr. 1972
Ann J. Roberts, Thomas F. Bobbitt, S. Richard Jaskanas, and Billy Richardson Feb. 1973 18 p refs
(AD-756836; SAM-TR-73-2) Avail: NTIS CSCL 06/1

In vitro suspensions of chicken erythrocytes, rabbit reticulocytes, and rat bone marrow cells have been used to examine the effects of oxygen tension on heme synthesis. The data indicate that heme synthesis is maximal at 10% O2 at approximately 745 torr (mm. Hg). Lesser O2 levels (0%, 3%, 5%, and 7%) greatly reduce heme synthesis, while higher levels (20% and 100%) moderately reduce it. Hemoglobin (i.e., globin) synthesis, as measured by the incorporation of H3-leucine, is unaffected by O2 tension. Although the synthesis of aminolevulinic acid (ALA) from glycine and succinate is considered the rate-limiting step in heme synthesis, the effects of O2 on the

incorporation of glycine-C14 and ALA-C14 into heme are similar. Since 10% O2 at 745 torr approximates mean tissue PO2 at sea level, the suppression of heme synthesis at O2 levels greater than 10% may indicate the effect of hyperoxia on heme synthesis in the intact animal. (Author Modified Abstract) GRA

N73-24126# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHYSICAL AND RADIOBIOLOGICAL INVESTIGATIONS ON ARTIFICIAL EARTH SATELLITES
E. E. Kovalyov and A. V. Kolomenskii 26 Dec. 1972 192 p refs Transl. into ENGLISH from the monograph "Fizicheskie i Radiobiologicheskie Issledovaniyana Iskusstvennykh Sputnikakh Zem' Moscow, 1971 p 1-199
(AD-756771; FTD-HC-23-1143-72) Avail: NTIS CSCL 06/18

The monograph presents experimental materials obtained on Earth orbiting space ships and data from the literature, summarizing physical and biomedical research in space. Results of research concerning the radiation environment in orbits of Earth orbiting space ships are presented. The principles of calculation of permissable radiation doses are given and physical protection of space ships is discussed. Radiation dangers are evaluated, using the permissable levels of cosmic radiation for man and other bio-objects. Results are presented of experiments involving the study of combined effect of radiation and other factors of space flight on animals, higher and lower plants, unicellular organisms and simulated biochemical systems. Author (GRA)

N73-24127# Rensselaer Polytechnic Inst., Troy, N.Y.
HIGH ALTITUDE PULMONARY EDEMA Annual Progress Report, 1 May 1972 - 31 Jan. 1973
Gerald Moss 13 Feb. 1973 49 p refs
(Contract DADA17-72-C-2121)
(AD-756940; APR-1) Avail: NTIS CSCL 06/5

A centrineurogenic etiology for the pulmonary changes of High Altitude Pulmonary Edema (HAPE) has been established. Respiratory hypoxia leads to the pathological pulmonary complex in unprotected beagles. These pulmonary changes are induced by isolated cerebral hypoxemia. The lungs do not develop this pattern during systemic, respiratory hypoxia, when the brain is perfused with autologous blood at normal oxygen saturation. Denervation of the left lung two months prior to isolated cerebral phyoxemia is protective of that lung, but not the normally innervated right lung, which develops the pathological complex. Directly monitored left atrial pressure ruled out heart failure as contributing to the pulmonary picture. Bilateral excision of the carotid bodies failed to alter the course of the lung complication. This confirms a direct effect of the cerebral hypoxia in the pathogenesis of the pulmonary sequence. The induction of HAPE by isolated cerebral hypoxemia is a universal, species independent phenomenon. This was reproduced in seven species of experimental animals, including primate (rhesus monkey). (Author Modified Abstract) GRA

N73-24128# Dayton Univ. Research Inst., Ohio.
A PROPOSED DISTRIBUTED PARAMETER MODEL FOR STUDYING THE EFFECTS OF ACCELERATION FORCES UPON THE ARTERIAL SYSTEM Final Technical Report, Feb. 1971 - Aug. 1972
Medhi Shirazi Jan. 1973 35 p refs
(Contract F33615-71-C-1296; AF Proj. 7220)
(AD-756530; URDI-TR-72-42; AMRL-TR-72-102) Avail: NTIS CSCL 06/19

A distributed parameter mathematical representation is obtained for the arterial system under stress resulting from headward acceleration. Assuming steady state conditions, solutions are obtained for the pressure and flow dynamics of the system in terms of the parameter distributions depicting the effects of viscous resistance, viscous inertance, compliance of the vessels and fluid outflow through the tubes. A computational scheme is proposed for determining the parameters of the system, based upon the difference between the measured system response under stress and the solution of the mathematical model.
Author (GRA)

N73-24129# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
ENGINEERING FOUNDATION CONFERENCE ON PATTERN INFORMATION PROCESSING
King-Sun Fu and Kendall Preston, Jr. 1972 81 p Conf. held at Warrenton, Va., 23-27 Feb. 1972
(Grant NSF GK-31955)
(PB-214617/3) Avail: NTIS HC $3.00 CSCL 06D

The major purposes of the conference were to assess the current position of the U.S. in this field, and to force a confrontation between the major areas of pattern information processing. These areas would include: robotics, biomedical pattern processing, picture processing, and remote sensing. It was concluded that: (1) There is a threat to U.S. technical leadership in pattern information processing by other countries. (2) Fundamental problems are shared by the major areas. (3) An Automation research council is needed to serve as an assembly point to integrate effort and enhance information transfer. Author (GRA)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N73-24130 Michigan Univ., Ann Arbor.
A CHARACTERIZATION OF THE VISIBILITY PROCESS AND ITS EFFECT ON SEARCH POLICIES Ph.D. Thesis
Michael Leo Moore 1972 318 p
Avail: Univ. Microfilms Order No. 72-29155

The problem is considered of characterizing the interaction between the detection and visibility processes in context of classical search theory. The work focuses on the study of search situations in which the target is not continuously visible to the searcher during the time period of the search. This intermittent visibility dimension occurs in many real world search processes, such as police patrols, medical screening, anti-submarine warfare, search for schools of fish aerial reconnaissance, and search for profitable research and development projects. Specifically, the problem considered is that of searching for a stationary target located in one of N regions. Models of different situations are developed. The following results are produced for each model: (1) an explicit description of optimal allocation policies and associated returns, (2) comparison of these policies and returns to those of the classical search theory, and (3) approximately optimal policies. It is shown that, under certain conditions, consideration of the visibility process leads to fundamentally different allocation policies. Dissert. Abstr.

N73-24131 Kansas State Univ., Manhattan.
SYSTEMS ANALYSIS OPTIMIZATION AND CONTROL OF LIFE SUPPORT SYSTEMS IN CONFINED SPACES Ph.D. Thesis
Norman Custodio Pereira 1972 304 p
Avail: Univ. Microfilms Order No. 72-28852

Two topics related to life support in confined spaces are studied. These are, the simultaneous control of temperature and humidity in a confined space, and the modeling of air flow and air quality in confined spaces. A pair of nonlinear differential equations which describe the transient behavior of temperature and humidity in a confined space are derived and linearized about a desired steady state operating point. Classical control theory is then used with these linear equations in order to synthesize feedback controllers for the simultaneous control of temperature and humidity. Various aspects of steady state analysis and modeling with regard to the reduction of odor and toxic gases in confined spaces are also discussed. On the basis of an experimental analysis a refined analytical model is developed which takes into account both active and stagnant regions. It is shown how toxicity can tend to build up within the stagnant regions and also what effect such a build up can have on the overall confined space. Dissert. Abstr.

N73-24132*# Fairchild Republic Div., Farmingdale, N.Y. Republic Div.
PERSONAL HYGIENIC CONCERNS IN LONG TERM SPACE FLIGHT
2 May 1973 26 p refs

(Contract NAS9-12866)
(NASA-CR-128929) Avail: NTIS HC $3.50 CSCL 06I

Data from numerous experiments and hardware inventories were scanned for Skylab personal hygiene use. A computer program was formulated for predicting the degree of man's involvement with personal hygiene needs. A tabulation was kept for such events as water intake, frequency of urination and defecation, accidents or events requiring clean-up, methods of clean-up, microbiological environment and shower water contamination. G. G.

N73-24133*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
BODY WATER COMPARTMENTS DURING BED REST: EVALUATION OF ANALYTICAL METHODS
H. L. Young, L. Juhos, B. L. Castle, J. Yusken, and J. E. Greenleaf Washington May 1973 22 p refs
(NASA-TR-R-406; A-4656) Avail: NTIS HC $3.00 CSCL 06P

Nine healthy young men were studied to determine the reproducibility and interchangeability of the use of radio-iodinated human serum albumin and Evans Blue dye for estimating plasma volume, sodium bromide for extracellular fluid volume, and deuterium oxide for total body water volume. All subjects were tested in a semibasal condition and allowed to rest for at least 30 min. after arriving at the laboratory. The results indicate that there was uniform distribution of I131 and Evans Blue dye 10 min. after injection and of NaBr and D2O 3 hours after oral ingestion; the buildup of residual tracer did not interfere appreciably with the measurement of either or Evans Blue spaces when they are administered at equal intervals, and the buildup of background tracer after ingestion of NaBr and D2O once per week for three consecutive weeks did not affect the accuracy of the measurement. It was found that I131 and Evans Blue may be used interchangeably for estimating plasma volume; for estimating bromide and D2O spaces, one 3-hour equilibrium blood sample gives results similar to the extrapolation of multiple samples. Author

N73-24134*# Systems Technology, Inc., Hawthorne, Calif.
VISUAL-MOTOR RESPONSE OF CREWMEN DURING A SIMULATED 90-DAY SPACE MISSION AS MEASURED BY THE CRITICAL TASK BATTERY
R. Wade Allen and Henry R. Jex Washington NASA May 1973 34 p refs
(Contract NAS2-6409)
(NASA-CR-2240) Avail: NTIS HC $3.00 CSCL 05E

In order to test various components of a regenerative life support system and to obtain data on the physiological and psychological effects of long duration exposure to confinement in a space station atmosphere, four carefully screened young men were sealed in a space station simulator for 90 days and adminstered a tracking test battery. The battery included a clinical test (Critical Instability Task) designed to measure a subject's dynamic time delay, and a more conventional steady tracking task, during which dynamic response (describing functions) and performance measures were obtained. Good correlation was noted between the clinical critical instability scores and more detailed tracking parameters such as dynamic time delay and gain-crossover frequency. The levels of each parameter span the range observed with professional pilots and astronaut candidates tested previously. The chamber environment caused no significant decrement on the average crewman's dynamic response behavior, and the subjects continued to improve slightly in their tracking skills during the 90-day confinement period. Author

N73-24135*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HABITABILITY DATA HANDBOOK. VOLUME 2: ARCHITECTURE AND ENVIRONMENT. SUPPLEMENT 2
May 1973 23 p
(NASA-TM-X-69322; MSC-03909-Vol-2-Suppl-2) Avail: NTIS HC $3.25 CSCL 05E

The data presented in this supplement is directed primarily at a zero gravity environment with considerations for operations in a one-g environment. The data was obtained from simulated zero gravity testing in a neutral buoyancy environment. Author

N73-24136*# AiResearch Mfg. Co., Los Angeles, Calif.
OBJECTIVE TECHNIQUES FOR PSYCHOLOGICAL ASSESSMENT Final Report
E. Wortz, W. Hendrickson, and T. Ross 14 Mar. 1973 111 p refs
(Contract NAS9-12771)
(NASA-CR-128945; Rept-73-9045) Avail: NTIS HC $7.75 CSCL 05E

A literature review and a pilot study are used to develop psychological assessment techniques for determining objectively the major aspects of the psychological state of an astronaut. Relationships between various performance and psychophysiological variables and between those aspects of attention necessary to engage successfully in various functions are considered in developing a paradigm to be used for collecting data in manned isolation chamber experiments. G.G.

N73-24137# Explosives Research and Development Establishment, Waltham Abbey (England).
THE EFFECT OF IGNITION OF SMALL QUANTITIES OF INITIATORS IN LABORATORY VESSELS OF GLASS AND POLYTHENE
S. Lamnevik, A. Bostroem (Res. Inst. of Natl. Defence, Sundbyberg, Sweden) et al Dec. 1972 19 p Transl. into ENGLISH from Swed. Rept. FOA-1-A-1452-40, Nov. 1968
(ERDE-Trans-1; FOA-1-A-1452-40) Avail: NTIS HC $3.00

The sizes and distribution of splinters from the detonation of an initiator such as undextrinated lead azide in some normal laboratory vessels of glass and polythene have been investigated. Injuries to dummy hands were studied. Recommendations were made when working with initiators in the laboratory. ESRO

N73-24138# McDonnell Aircraft Co., St. Louis, Mo.
THE HIGH G APPROACH
P. V. Kulwicki and J. M. Sinnett 20 Feb. 1973 26 p
(Contract F33615-72-C-1574; AF Proj. 7184)
(AD-757216; MDC-A2169; AMRL-TR-73-27) Avail: NTIS CSCL 05/6

The High g Approach is an innovative approach to cockpit design which provides a unique match of pilot capabilities and airplane performance potential. The High g Approach provides an option for the pilot to think, command and control his aircraft at sustained load factor levels well above 7 G. The result, in the context of emerging fighter capability, is a dramatic increase in combat effectiveness and operational advantage.
Author (GRA)

N73-24139# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
EVALUATION OF HOLOGRAPHIC ELEMENTS IN A HEADS-UP DISPLAY Final Report, 3 Apr. - 31 Oct. 1972
John N. Latta and Edwin B. Champagne Mar. 1973 45 p refs
(Contract N00123-72-C-1738)
(AD-758057; Rept-11057-3-F) Avail: NTIS CSCL 05/5

The report covers work on the application of a hologram optical element to a pilot's heads-up display. Two problem areas are addressed: the compensation of a wavelength shift in the hologram geometry from construction to reconstruction, and compensation of the effects of dispersion on the image in a hologram element system as a result of the spectral bandwidth of the illumination source. To examine these areas, a general vector formulation of hologram grating properties is developed. This permits the analysis of holograms recorded on either flat or curved surfaces. The wavelength shift correction of both the aberrations and first-order imaging properties of a hologram is accomplished by designing the construction geometry to offset the change in wavelength upon reconstruction. Applying these techniques to both the flat and curved surface geometries results in considerable performance improvement. (Author Modified Abstract) GRA

N73-24140# American Inst. for Research, Washington, D.C.
HUMAN ENGINEERING GUIDE TO EQUIPMENT DESIGN (REVISED EDITION)
Harold P. VanCott, ed. and Robert G. Kinkade, ed. 1972 788 p refs Revised Sponsored in part by Army-Navy-Air Force Steering Comm.

(Contract N00014-70-C-0365)
(AD-758339; LC-72-600054) Avail: NTIS MF $0.95; SOD HC $8.00 CSCL 05/5

Contents: system and human-engineering analyses; man as a system component; visual presentation of information; auditory and other sensory forms of information presentation; speech communication; man-machine dynamics data entry devices and procedures; design of controls; design of individual workplaces; design of multi-man-machine work areas; engineering anthropology; designing for maintainability; training system design; training device design; and human engineering tests and evaluation.

Author

N73-24141# Army Foreign Science and Technology Center, Charlottesville, Va.
PARACHUTE OXYGEN APPARATUS
A. Seliverstov 21 Jun. 1972 7 p refs Transl. into ENGLISH from Krylya Rodiny (USSR), no. 4, 1969 p 29
(AD-756554; FSTC-HT-23-398-70) Avail: NTIS CSCL 06/11

The translation describes the KP-23 breathing apparatus used by parachutists. GRA

N73-24142# School of Aerospace Medicine, Brooks AFB, Tex.
EFFECT OF LOW HUMIDITY ON HUMAN PERFORMANCE Final Report, Sep. 1971 - Mar. 1972
William F. Storm, Peter H. Henry, James F. Sanford, III, and James C. Noah Feb. 1973 18 p refs
(AD-756835; SAM-TR-73-3) Avail: NTIS CSCL 06/19

Human volunteers were trained to high levels of proficiency on three tasks involving various degrees of psychomotor and cognitive skills. Environments of 0.5-mm. water vapor pressure and/or simulated 8,000-ft barometric pressure had no adverse effects on performance during four 36-hour chamber exposures. Systematic day-night variations were found for Multidimensional Pursuit tracking skill and self-ratings of subjective fatigue.

Author (GRA)

N73-24143# Singer Co., Binghamton, N.Y. Simulation Products Div.
NAVAL PILOT TRAINING SYSTEM STUDY. VOLUME 1: BASIC REPORT Final Report
Harry W. Erickson, Duncan W. Simpson, Edward A. Stark, T. R. Dailey, and Banjamin Schohan Orlando, Fla. Naval Training Equipment Center Dec. 1972 585 p refs Prepared in cooperation with N. Am. Aviation, Columbus, Ohio 3 Vol.
(Contracts N61339-72-C-0049; N61339-72-C-0136)
(AD-756638; NAVTRAEQUIPC-72-C-0049-1-Vol-1) Avail: NTIS HC $10.50/set of 3 reports as AD-756638-set CSCL 05/9

The study defined a cost effective program for training Naval fixed-wing pilots during the 1974-1986 time frame. It identified requirements for the Undergraduate Pilot Training program anticipated for that period, and evaluated elements of the current program, and the education and training technologies for their ability to economically fulfill them. The behavior objectives of the future program were defined through the analysis of the flight tasks trained in the present program, likely to be relevant in the future. Major system elements having significant impact on the development of these objectives were identified, and recommendations developed for restructuring the program to reduce cost while maintaining current levels of pilot proficiency. (Author Modified Abstract) GRA

N73-24144# Singer Co., Binghamton, N.Y. Simulation Products Div.
NAVAL PILOT TRAINING SYSTEM STUDY. VOLUME 2: APPENDICES A, B, C, AND D. Final Report
Harry W. Erickson Orlando, Fla. Naval Training Equipment Center Dec. 1972 38 p refs Prepared in cooperation with N. Am. Aviation, Columbus, Ohio 3 Vol.
(Contracts N61339-72-C-0049; N61339-70-C-0136)
(AD-756639; NAVTRAEQUIPC-72-C-0049-1-Vol-2) Avail: NTIS HC $10.50/set of 3 reports as AD-756638-set CSCL 05/9

Contents: Current system definition; Discussion of training objectives; Recommendations; Costs. GRA

N73-24145# Singer Co., Binghamton, N.Y. Simulation Products Div.
NAVAL PILOT TRAINING SYSTEM STUDY. VOLUME 3: EXECUTIVE SUMMARY Final Report
Harry W. Erickson Orlando, Fla. Naval Training Equipment Center Dec. 1972 38 p refs Prepared in cooperation with N. Am. Aviation, Columbus, Ohio 3 Vol.
(Contracts N61339-72-C-0049; N61339-70-C-0136)
(AD-756640; NAVTRAEQUIPC-72-C-0049-1-Vol-3) Avail: NTIS HC $10.50/set of 3 reports as AD-756638-set CSCL 05/9

The study investigated the Naval Undergraduate Pilot (fixed-wing) Training (UPT) Program and produced recommendations for the modification of the program to reduce cost while maintaining the current level of graduate quality. The study analyzed the capabilities of elements of the current system, the pilot training requirements anticipated for the 1974-1986 time period, and capabilities within the pilot training state of the art for economically fulfilling those requirements. Six training system elements, selected for their discrete impact on system cost, training effectiveness and susceptibility to analysis and improvement were evaluated. Two criteria were established for the evaluation of each system element and for the selection of new or modified elements. They are training effectiveness and training cost.

GRA

N73-24146# Naval Aerospace Medical Research Lab., Pensacola, Fla.
THE USE OF CONFIDENTIAL INSTRUCTOR RATINGS FOR THE PREDICTION OF SUCCESS IN NAVAL UNDERGRADUATE PILOT TRAINING
Wayne L. Waag, Richard H. Shannon, and Rosalie K. Ambler 7 Feb. 1973 19 p refs
(AD-757693; NAMRL-1175) Avail: NTIS CSCL 05/9

Previous investigations have reported significant relationships between confidential instructor ratings in early primary phase and later success in Naval flight training. Such ratings were found to increase significantly the validities derived solely from selection test scores. However, such findings do not guarantee that confidential ratings would augment the validities derived from the combined array of selection and early training variables which are used in the current student pilot prediction system. The purpose of the present study was to determine whether such confidential ratings provided non-redundant information which would increase the predictive value of the present system. The results clearly indicated that confidential ratings obtained from primary flight instructors provided information relating to the student's probability of receiving his wings. Such ratings were found to significantly increase the predictive validities derived from the variables which are used currently in the student pilot prediction system. Such findings suggest that these confidential evaluations provide additional information beyond that which is reflected in the grades he assigns. It is recommended that confidential instructor ratings be implemented on a permanent basis in the presolo stage. The present student pilot prediction system should be revised to incorporate this information.

Author (GRA)

N73-24205 Ministry of Education and Sciences-Documentation Department, The Hague (Netherlands).
TRAINING OF PERSONNEL TO MAN THE VARIOUS PARTS OF AN INFORMATION CENTRE AND TO OPERATE VARIOUS KINDS OF SERVICE
W. F. DeRegt *In* AGARD Governmental Assistance for Tech. Inform. in Ind. and Simple Mechanization for Small Inform. Centres Mar. 1972 4 p (For availability see N73-24201 15-08)

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N73-24147 Princeton Univ., N.J.
THE STATIC DIELECTRIC CONSTANT OF SOLID METHANE AT LOW TEMPERATURES AND HIGH PRESSURES Ph.D.

Thesis
Marc Shaw Constantino 1972 138 p
Avail: Univ. Microfilms Order No. 72-29773

The static dielectric constant of solid methane is measured over a range to 10% above the triple point density and in temperature from 13K to the melting curve. A density and temperature dependent static dielectric constant is found. The molecular polarizability, calculated using the Clausius-Mossotti function, displays a slight temperature and density dependence but may be taken to be a constant, 6.54 cu cm/mole, within the experimental error. The low temperature solid-solid phase diagram is determined and has a triple point of 33.85K and 3.6Kbar. A new dielectric anomaly in high density methane crystals has been found and tentatively identified as ferroelectric or antiferroelectric. Dissert. Abstr.

N73-24148 National Lending Library for Science and Technology, Boston Spa (England).
THE MEASUREMENT OF OXYGEN SATURATION CONCENTRATIONS IN SODIUM BY EMF DETERMINATION
H. U. Borgstedt 12 Mar. 1973 8 p refs Transl. into ENGLISH from Atomnirtschaft (Duesseldorf), v. 17, Jul. 1972 p 361-362
(NLL-CE-Trans-6073-(9022.09)) Avail. Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A method in which the measurement of electro-chemical potentials of oxygen concentration cells is utilized with the assistance of solid electrolytes, has recently been used for determining the saturation concentrations of oxygen in liquid sodium. For the tests reported here a commercial test rig was used. Author

N73-24149 National Lending Library for Science and Technology, Boston Spa (England).
POLYMETHACRYLATES IN AUTOMOTIVE OILS - VI IMPROVERS. 1: INVESTIGATIONS OF WEAR
U. Schoedel, P. Neudoerfl, and H. Jost 12 Mar. 1973 13 p refs Transl. into ENGLISH from Erdoel Kohle (Hamburg), v. 25, no. 5, May 1972 p 261-264
(NLL-Trans-1190-(9022.9)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

For a number of European car engines, wear experiments with automotive oils containing polymethacrylate were carried out on the test rig and in road tests. It was shown that, with these oils, the wear inhibiting effect is determined not so much by the viscosity of the oils as by the polymer content, the molecular weight of the polymethacrylate and the solution properties of the base oil. By suitable harmonization of these parameters, the wear inhibiting effect of oils containing polymethacrylate can be considerably improved. The improvement of the wear inhibiting effect through addition of polymethacrylate was found not only on the main and big-end bearings but also on other engine components, for instance cylinders, piston rings and tappets. Author

N73-24150 National Lending Library for Science and Technology, Boston Spa (England).
THE PROBLEM OF DESILIFICATION IN GRZYMEK'S SINTERING-DISINTEGRATION METHOD
K. Hubicka 8 Feb. 1973 14 p refs Transl. into ENGLISH from Przem. Chem. (Poland), v. 51, no. 2, 1972 p 102-106
(NLL-Lib-Trans-1725-(5205.9)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Desilification in the sintering-disintegrating method for producing alumina and cement is obtained by leaching with a solution of calcium carbonate and subsequent decanting. The addition of calcium hydroxide in a stoichiometric amount reduces aluminum loss during the desilification process. G.G.

N73-24151 National Lending Library for Science and Technology, Boston Spa (England).
A MASS-SPECTROMETRIC METHOD FOR THE ANALYSIS OF AROMATIC HYDROCARBONS AND SULFUR COMPOUNDS
E. S. Brodskiy, R. A. Khmelnitskii, A. A. Polyakova, and I. M. Lukashenko 12 Mar. 1973 10 p refs Transl. into ENGLISH from Khim. Technol. Topl. Masel (Moscow), v. 17, no. 9, 1972 p 55-58
(NLL-Trans-1193-(9022.9)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Mass spectral characteristics are calculated for aromatic hydrocarbons and sulfur compounds relative to molecular structure and mean group coefficients of the mutual overlapping of the characteristic sums and sensitivity coefficients in the mass spectra. The content of 23 groups of compounds is subsequently established with a relative error of 10% and a sensitivity of determination of 2% to 3%. Author

N73-24152 National Lending Library for Science and Technology, Boston Spa (England).
SAMPLING AND ANALYSIS OF POLYCYCLIC AROMATIC HYDROCARBONS IN AUTOMATIVE VEHICULAR EXAUST GAS. PART 1: OPTIMIZATION OF THE COLLECTING DEVICE. ENRICHMENT OF THE POLYCYCLIC AROMATIC HYDROCARBONS
G. Grimmer, A. Hildebrandt, and H. Boehnke 12 Mar. 1973 22 p refs Transl. into ENGLISH from Erdoel Kohle (Hamburg), v. 25, no. 8, Aug. 1972 p 442-447
(NLL-Trans-1191-(9022.9)-Pt-1) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The optimization of a simple collection procedure for polycyclic aromatic hydrocarbons in the boiling range 338 C to above 500 C is described. The separating efficiency of the filter combination tested is controlled by a double filter of silica gel under operating conditions. The proposed collecting device consists of a glass condenser and a micron filter of impregnated fiber glass material. The micron filter has a degree of separation of 99.998% for particles of size 0.3 - 0.5 micrometer at a nominal air flow of 50 cu m/h and a maximum flow resistance of 15 mm water column. For the enrichment of the polycyclic aromatic hydrocarbons from the separated particulate phase, a multi stage procedure is described. Author

N73-24153 National Lending Library for Science and Technology, Boston Spa (England).
STUDY OF ELECTRICAL TRANSFER IN MOLTEN Ag-Ge AND Cu-Ge AT 1100 C
Yu. P. Bychkov and D. K. Belashchenko [1973] 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), v. 11, 1972 p 118-121
(NLL-M-21613-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Electrical transfer in molten Ag-Ge and Cu-Ge at 1100 C in vertical graphite capillaries has been studied by the method of reaching a steady state followed by chemical analysis. The electrical resistance at 1100 C was measured for the Ag-Ge system. The factor g, this being the characteristic of the density of electron states at the Fermi level, has been calculated from the results of measuring electrical transfer and from published data for Ge and Cu. The experimental factors g which have been found agree well with theoretical values. Author

N73-24154 American Univ., Washington, D.C.
THE INFLUENCE OF SELECTED ANIONS AND CATIONS ON THE CORROSION OF ALUMINUM ALLOYS Ph.D. Thesis
Alayne Anne Adams 1972 136 p
Avail: Univ. Microfilms Order No. 72-30078

Four techniques were used to study the corrosion of aluminum alloys: immersion tests, selected structural studies, polarization studies, and the scrape technique. Emphasis was placed on the scrape technique which provides a method of studying a fresh metal surface in contact with an electrolyte solution. There was general agreement in the results of the methods. In electrolyte solutions, results of the scrape technique were indicative of active or passive solutions. Active solutions showed small differences between the scrape potential and the steady state potential and lower rate of return of potential from the scrape potential to the steady state potential. Passive solutions showed larger differences between the scrape potential and the steady state potential, and larger rates of return of potential from the scrape potential to the steady state potential. The aluminum alloys in identical electrolyte solutions showed different behavior due to the alloying components. The experimental results can best be interpreted in terms of the formation of an aluminum complex species as an intermediate in the reaction process between the aluminum and the electrolyte solution. Dissert. Abstr.

N73-24155# Defence Standards Labs., Maribyrnong (Australia).
A QUANTITATIVE ANALYSIS OF TERMINAL EPOXY AND TERMINAL OLEFINIC GROUPS USING NEAR INFRARED SPECTROSCOPY
R. W. Pettis and A. T. Phillip Feb. 1973 23 p refs
(TN-287) Avail: NTIS HC $3.25

The near infrared absorption spectra of a series of terminal epoxy and terminal olefinic compounds were examined in the region 1600 to 2400 nm. Several solvents were investigated for suitability in this region and of these, carbon tetrachloride was chosen as the most widely applicable. Assignments were made for a combination band at 2205 nm for terminal methylene groups. These bands obey Beers Law in the concentration range 1 to 5 g/100 ml and may be used for quantitative determination of the respective functional groups. Author

N73-24156*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SURVEY OF APPLICATION OF RADIATION TO PREPARATIVE CHEMISTRY
Warren H. Philipp Washington May 1973 34 p refs
(NASA-TN-D-7285; E-7264) Avail: NTIS HC $3.00 CSCL 07E

The use of radiation for preparative chemistry in liquid solutions is investigated. General principles are presented and preparations involving reduction, oxidation, polymerization, and decomposition are given. The use of various solvents, water, other inorganic liquids and organic liquids for this purpose is discussed. Finally, a commentary is made on some specific applications where radiation chemistry as a preparative technique may be useful. Author

N73-24157# Bureau of Mines, Minneapolis, Minn.
IONIC AND NEUTRAL REACTIONS IN GLOW DISCHARGES OF A He-SO2-CO MIXTURE
David G. Kuehn, S. E. Khalafalla, and L. M. Chanin 1973 21 p refs
(BM-RI-7747) Avail: NTIS HC $3.25

Mass spectrographic studies have been conducted on the positive ions and neutral species of glow discharges containing 1.0% SO2 and 1.0% CO in helium. Measurements were conducted for gas pressures from 3.5 to 10.1 torr using both dc and 60-Hz ac excitation. The ion species that were observed included S(+), SO(+), SO2(+), O(+), O2(+), C(+), CO(+), and CO2(+) with lesser amounts of SO3(+), (CO)2(+), SCO(+), and (SO.CO)+ or CS2(+). Interpretation of the functional dependence of the various ionic and neutral species on pressure and applied power showed that CO reacted with the SO formed in the discharges to produce CO2 and sulfur. Deposition of elemental sulfur was observed in the plasma container. Author

N73-24158*# Pittsburgh Univ., Pa. Dept. of Chemistry.
ABSOLUTE RATE CONSTANT FOR THE O PLUS NO CHEMILUMINESCENCE IN THE NEAR INFRARED
Michael F. Golde, Aidan E. Roche, and Frederick Kaufman May 1973 26 p refs
(Grant NGR-39-011-002; Contracts DA-31-124-ARO(D)-440; f19628-70-C-0255; ARPA Order 826)
(NASA-CR-132157; SRCC-187) Avail: NTIS HC $3.50 CSCL 07D

Infrared chemiluminescence from the process O + NO (+M) NO2 + hv (+M) has been studied between 1.3 and 4.1 micrometer. The wavelength dependence of the continuum between 1.3 and 3.3 micrometer is in fair agreement with previous studies and the measured radiative rate constant at 1.51 micrometer establishes the NO-O glow in this spectral range as a secondary emission standard. Comparison with previous studies of the visible region of the glow implies that the overall radiative rate constant lies in the range (9.4 to 11.2) x 10 to the minus 17 power cu cm sec/1. In the region 3.3 to 4.1 micrometer, the previously observed broad band, peaking at 3.7 micrometer, shows a complex kinetic dependence on O and M. Author

N73-24159*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
DIATOMIC PREDISSOCIATION LINE WIDTHS
M. S. Child 30 Mar. 1973 89 p refs Submitted for publication
(Grant NGL-50-002-001)
(NASA-CR-131262; WIS-TCI-416) Avail: NTIS HC $6.50 CSCL 07D

Predissociation by rotation and curve crossing in diatomic molecules is discussed. The pattern of predissociation line widths is seen as providing a highly sensitive yardstick for the determination of unknown potential curves. In addition, the computation of such a pattern for given potential curves is considered a matter of routine, unless the predissociation happens to occur from an adiabatic potential curve. Analytic formulas are used to provide physical insight into the details of the predissociation pattern, to the extent that a direct inversion procedure is developed for determination of the repulsive potential curves for Type 1 predissociations. Author

N73-24160*# Northeastern Univ., Boston, Mass. Dept. of Physics.
THE LOW FREQUENCY RAMAN SPECTRA OF AMMONIUM HALIDES IN THE DISORDERED PHASES 1 AND 2
Michel Couzi, C. H. Perry, and J. B. Sokoloff [1971] 26 p refs
(Grant NGL-22-011-051)
Avail: NTIS HC $3.50 CSCL 07D

Raman scattering data on ammonium halides in 1 and 2 disordered phases are reported. The effects of disorder and that of short range ordering is discussed in terms of group theoretical arguments. Author

N73-24161*# Florida Univ., Gainesville.
AN IVESTIGATION OF THE PREPARATION OF HIGH MOLECULAR WEIGHT PERFLUOROCARBON POLYETHERS Final Report
Richard O. Watts and Paul Tarrant [1972] 63 p
(Contract NAS7-730)
(NASA-CR-132055) Avail: NTIS HC $5.25 CSCL 07D

High molecular weight perfluorocarbon polyether gums have been obtained by photolysis of perfluorodienes and diacyl fluorides containing a perfluorocarbon polyether backbond. A method has been developed whereby reactive acyl fluoride and trifluorovinyl end groups are converted into inert structures. In order to investigate the possible preparation of difunctional molecules which may be useful in polymer synthesis, the reactions of hexafluoropropene oxide (HFPO) with Grignard and organolithium reagents have been studied. Reactions of various nucleophilic reagents with HFPO have also been investigated. Author

N73-24162# Bhabha Atomic Research Centre, Bombay (India). Radiochemistry Div.
THERMAL DECOMPOSITION OF RARE EARTH OXALATES IN VACUUM
S. Sampath and D. M. Chackraburtty 1972 19 p refs
(BARC-631) Avail: AEC Depository Libraries

Thermal decomposition studies on oxalates of molybdenum, samarium, gadolinium, dysprosium, erbium, terbium and yttrium were carried out in vacuum from room temperature up to 1000 C. The studies revealed the formation of oxygen deficient rare earth oxides. The decomposition products in vacuum were found to contain carbon to the extent of about 2%. There was no evidence of formation of peroxide. Author

N73-24163# Arkon Scientific Labs., Berkeley, Calif.
DEVELOPMENT OF AN INFRARED FLUORESCENT GAS ANALYZER
E. A. McClatchie Aug. 1972 13 p refs
(Contract CPA-70-152)
(PB-213846/7; EPA-R2-72-121; ARFR-14) Avail: NTIS HC $3.00 CSCL 07B

A prototype model low level carbon monoxide analyzer was developed using fluorescent cell and negative chopping techniques to achieve a device superior to state of art NDIR (Nondespersive infrared) analyzers in stability and cross-sensitivity to other gaseous species. It is clear that this type of analyzer has that capacity. The prototype analyzer, which is a self-contained unit powered from 115V 60 Hz line, showed an ultimate detectivity to CO of approximately 1 ppm. and no measurable cross sensitivity to any other gaseous species at the level normally found in the ambient atmosphere. The theory and results of the research are summarized. GRA

N73-24164# Purdue Univ., Lafayette, Ind. Thermophysical Properties Research Center.
THERMOPHYSICAL PROPERTIES INFORMATION ANALYSIS CENTER: A CONTINUING SYSTEMATIC PROGRAM ON TABLES OF THERMOPHYSICAL PROPERTIES OF MATERIALS Final Report, 1 Jan. 1971 - 30 Sep. 1973
Cho-Yen Ho Jan. 1973 188 p refs
(Contract F33615-71-C-1182; AF Proj. 8795)
(AD-758175; AMMRC-CTR-73-5) Avail: NTIS CSCL 07/4

The report describes the activities and accomplishments of the Thermophysical Properties Information Analysis Center(TPIAC) during the period 1 January 1971 to 30 September 1972. TPIAC's activities include literature search, acquisition, review, and codification; substance classification and organization; operation of a computerized information storage and retrieval system; publication of the Thermophysical Properties Research Literature Retrieval Guide Supplements; information and data extraction and compilation; data evaluation, correlation, analysis, synthesis, and generation of recommended reference values; publication of the TPRC Data Series; preparation of state-of-the-art summaries and critical reviews; technical and bibliographic inquiries services; and current awareness and promotion efforts. (Author Modified Abstract) GRA

N73-24165# Army Foreign Science and Technology Center, Charlottesville, Va.
HEAT AND MASS TRANSFER WITH CHEMICAL TRANSFORMATIONS IN A REACTING BOUNDARY LAYER
G. T. Sergeev and L. I. Tarasevich 17 Jan. 1973 12 p ref Transl. into ENGLISH from the publ. "Dissotsiiruyushchiye Gazy Kak Teplonosjteli i Rabochiye Tela Energeticheskikh Ustanovok" Minsk, Navka i Tekhn., 1970 p 229-237
(AD-758210; FSTC-HT-23-245-73) Avail: NTIS CSCL 07/4

In the investigation of heat and mass transfer with phase and chemical transformations, homogeneous reactions are assumed to occur both in the well-defined reaction zone and in a region close to the surface of a porous body. Ethyl alcohol or hexane was used as the injectant supplied through the porous wall of the body. Diffusional combustion is one of the assumptions in this study. Author (GRA)

N73-24166# California Univ., Berkeley. Dept. of Chemical Engineering.
MORPHOLOGY OF PLASMA-POLYMERIZED ETHYLENE
M. Niinomi, H. Kobayashi, A. T. Bell, and M. Shen 15 Mar. 1973 26 p refs
(Contract N00014-69-A-0200-1053; NR Proj. 356-526)
(AD-758099; TR-3) Avail: NTIS CSCL 07/4

Replica electron microscopy has been used to observe the surface features of polymers produced by passing ethylene through a radiofrequency electric discharge. It is found that at low pressures and flow rates spherical powder particles are formed ranging in size between 0.2 and 1 micrometer. At high pressures and flow rates a film devoid of particles is formed. The role of the substrate on which the polymer is deposited has been investigated using chromium, Teflon, glass, and freshly cleaned mica as substrates. These materials are listed in order of increasing smoothness. From the electron micrographs it is observed that the surface structure of the substrate is reproduced in the plasma-polymerized films as long as the film is thin. (Author Modified Abstract) GRA

N73-24167# Brown Univ., Providence, R.I. Dept. of Chemistry.
VIBRATIONAL SPECTRAL STUDY OF MOLECULAR ORIENTATION IN VITREOUS FIBERS
Philip J. Miller, Gregory J. Exarhos, and William M. Risen, Jr. 21 Mar. 1973 28 p refs
(Contract N00014-67-A-0191-0024; NR Proj. 051-539)
(AD-757751; TR-73-01) Avail: NTIS CSCL 07/4

Preferential orientation of polymeric chains with respect to the principal axis in completely non-crystalline, vitreous fibers is demonstrated by laser Raman and infrared reflectance study of sodium metaphosphate glass fibers. The polarization dependence of Raman intensities in 24 scattering arrangements have been obtained by varying the incident and scattered radiation propagation and polarization directions and are compared to calculated Raman intensity ratios for uniaxial orientation of the chains. Infrared dichroic ratio data were obtained from a Kramers-Kronig transformation analysis of polarized reflection spectra on oriented fibers, and employed to compute the averages of the angles the metaphosphate chains make with the fiber axis. Author (GRA)

N73-24168# Tyco Labs., Inc., Waltham, Mass.
CATALYSIS OF HYDROCARBON OXIDATION WITH ADSORBED LAYERS Final Technical Report, 20 Nov. 1971 - 19 Nov. 1972
S. B. Brummer, M. J. Turner, S. D. Kirkland, and H. Feng Dec. 1972 70 p refs
(Contract DAAK02-71-C-0117; DA Proj. 1T0-61102-A-34A)
(AD-758172; C-108-F) Avail: NTIS CSCL 07/4

Studies were made on the effects of added Cd(2-), Ni(2-), Na(-), Zn(2-), Pd(2-), and Co(2-) on the oxidation rate of C3H8 in H3PO4 of concentration 80 to 95 wt % at 130C on platinized Pt electrodes. Dissolved Cd(2-) discharges, probably as Cd, and forms a stable submonolayer on a Pt electrode at potentials as high as 0.5 V versus RHE. This Cd layer inhibits C3H8 adsorption even though it itself is apparently substantially desorbed in favor of adsorbed hydrocarbon. The Cd layer inhibits the C3H8 oxidation rate. However, the C3H8 oxidation rate is observed to increase under some circumstances. Co-plating of Cd and Pt leads to an electrode which, once the excess Cd has been removed, appears to be stable, and which catalyzes C3H8 oxidation. Ni(2-) catalyzes C3H8 and CH4 oxidation, although no Ni is formed on the electrode. The research was part of a study of hydrocarbon air fuel cells. GRA

N73-24169# Naval Weapons Center, China Lake, Calif. Research Dept.
PREWET NUCLEATION OF SUPERCOOLED WATER BY ORGANIC CHEMICALS UNDER OPTIMUM TEST CONDITIONS
Aaron N. Fletcher Mar. 1973 38 p refs
(AD-758002; NWC-TP-5455) Avail: NTIS CSCL 07/4

Over 140 organic compounds were examined for their activity in nucleating super-cooled water using a high degree of interfacial contact with drops that were 40 plus or minus 10 micro-liter in size. It was found that a single freeze caused a significant deactivation of most of the test materials. Despite a minute-wise time delay in nucleation, median temperatures of freezing showed an average relative standard deviation of only 0.16. Thirteen of the compounds gave test results better than or equivalent to those of silver iodide. There appears to be some agreement between molecular structure and ice-nucleation activity, but not as much as would be liked. Many of the organic compounds would have limited lifetimes as cloud-seeding agents due to high vapor pressure, high water solubility, or formation of low activity hydration compounds. However, it is noted that short-lived ice nucleating materials will be essential to precise cloud seeding. Author (GRA)

N73-24170# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
EXPERIMENTAL LABORATORY STUDIES ON ELECTRON COLLISION PROCESSES IN ATMOSPHERIC GASES Final Report, 1 Dec. 1966 - 30 Nov. 1972
G. J. Schulz, P. D. Burrow, M. J. W. Boness, D. Spence, and L. Sanche 1973 14 p refs
(Contracts DA-ARO(D)-31-124-G880; DA-ARO(D)-31-124-G39)
(AD-757841; AROD-7091-16-P) Avail: NTIS CSCL 07/4

Research topics briefly summarized include vibrational excitation in NO and O2; three-body attachment in O2 and its temperature dependence; resonance in CO, O2, and NO. Similar studies were performed on triatomic molecules. Author (GRA)

N73-24171# Texas Univ., Austin.
RAMAN SPECTRA OF VAN DER WAALS COMPLEXES IN ARGON
Clifford Eugene Morgan and L. Fromhold 12 Jan. 1973 136 p refs
(Contract F44620-71-C-0091; AF Proj. 4751)
(AD-758241; TR-142; AFOSR-73-0561TR; TR-142) Avail: NTIS CSCL 07/4

The Raman spectra of high purity helium, xenon, and especially argon, were observed at a number of temperatures between the boiling points and 300K and pressures from vacuum to four atmospheres. Because of the high sensitivity of the experiment,

the spectra were obtained at gas densities for which predominantly two-body collisions occurred and at gas temperatures widely different from room temperature, in contrast to previous work in this field. The scattering is completely depolarized and the ratio of the Stokes intensity to the anti-Stokes intensity is equal to a Boltzmann factor. In the spectra of argon, a continuous band structure resembling an unresolved pure rotation band was observed. The wavelength, corresponding to the peak of the band structure, shifts with temperature in agreement with the theoretical shifts for a pure rotation band of a diatomic molecule. A similar band structure was observed for xenon, but with peaks evidently so close to the Rayleigh line that only shoulders were resolved. In the case of helium, only slight scattering was observed at the lowest temperature and highest pressure. These new results do not completely agree with present theories of light scattering by noble gases. It is suggested that the light scattering is due to a metastable Van der Waals dimer or complex. (Author Modified Abstract) GRA

N73-24172*# Aerospace Corp., El Segundo, Calif.
EXCITATION OF THE W TRIPLET DELTA (U), W SINGLET DELTA (U), B PRIME TRIPLET SIGMA (U) (MINUS), AND A PRIME SINGLET EPSILON (U) (MINUS) STATES OF N2 BY ELECTRON IMPACT Technical Report, May - Dec. 1972
David C. Cartwright, Ara Chutjian, and Sandor Trajmar 28 Feb. 1973 20 p refs
(Contracts F04701-72-C-0073; NAS7-100)
(NASA-CR-132174; SAMSO-TR-73-132; AD-758761; TR-0073(9260-01)-10) Avail: NTIS HC $3.00 CSCL 07/4

Electron energy-loss spectra have been obtained for N2 at 20.6 eV impact energy, and scattering angles of 10-138 deg. The differential cross section for excitation of the W triplet Delta(U) state is the largest triplet-state cross section at all scattering angles, and is the largest inelastic cross section at angles greater than 70 degrees. (Author Modified Abstract) GRA

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N73-24173 British Broadcasting Corp., Kingswood (England). Research Dept.
RADIO MICROPHONE: PROPAGATION CHARACTERISTICS IN TELEVISION STUDIOS
R. D. C. Thoday Apr. 1973 9 p ref
(BBC-RD-1973/3; RA-106) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Propagation conditions which exist in television studies for the operation of radio microphones are studied. Measurements of field strength and analysis show similar results for all frequencies. It is concluded that considerable improvement results from using some form of diversity reception, and a quadruple diversity system with a transmitter output power of about 25 to 50 mW is considered for permanent studio installation. Author

N73-24174 National Lending Library for Science and Technology, Boston Spa (England).
COMPENSATION OF THE VIDICON SIGNAL DARK COMPONENT
E. P. Tsvetov and V. V. Galushchenko 12 Mar. 1973 10 p refs Transl. into ENGLISH from Tekh. Kino i Tele. (USSR), v. 7, 1972 p 52-55
(NLL-DRIC-Trans-2967-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A method is proposed for the compensation of the dark component in the video signal of a vidicon; the method consists in the fact that in the course of the period of storage the vidicon screen is subjected to an additional charging process, by a weak electron beam, at a cathode potential which is more negative than during the computation period. The experimental verification of the proposed method has confirmed its effectiveness and applicability both for multi-frame and for usual television cameras with vidicons. The method makes it possible to maintain the maximum dynamic range of the video signal computed in the vidicon even over long periods of storage and with potential on the signal plate, and at the same time to make a real increase in the sensitivity of the vidicon and to improve the transmission of light gradation. Author

N73-24175 National Lending Library for Science and Technology, Boston Spa (England).
THE DAY OF ELECTRONICS
R. Galley 8 Apr. 1973 6 p refs Transl. into ENGLISH from Postes Telecommun. (Paris), v. 17, no. 197, May 1972 p 3-4
(NLL-PO-2957-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The industrialization and massive introduction of electronic switching in the telephone network of France is projected. Positive results from an experimental electronic telephone exchange operation are outlined. G.G.

N73-24176* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COLLAPSIBLE STRUCTURE FOR AN ANTENNA REFLECTOR Patent
Marc R. Trubert, inventor (to NASA) Issued 24 Apr. 1973 12 p Filed 26 Oct. 1971 Supersedes N72-20153 (10 - 11, p 1439) Sponsored by NASA
(NASA-Case-NPO-11751; US-Patent-3,729,743; US-Patent-Appl-SN-192141; US-Patent-Class-343-915; US-Patent-Class-343-DIG.2) Avail: US Patent Office CSCL 17B

A collapsible support for an antenna reflector for use in supporting spacecraft antennas is described. The support has a regid base and a number of struts which are pivoted at the base. The deployment of the struts and their final configuration for supporting the antenna are illustrated. P.N.F.

N73-24177 Maryland Univ., College Park.
OPTIMUM ESTIMATION OF A DELAY VECTOR CAUSED BY A RANDOM FIELD PROPAGATION ACROSS AN ARRAY OF NOISY SENSORS Ph.D. Thesis
William Robert Hahn 1972 75 p
Avail: Univ. Microfilms Order No. 72-29214

The problem of optimally processing multiple sensor data to determine the set of time delays generated by the propagation across an array of the wavefronts from a distant wideband Gaussian noise source is investigated. It is assumed that the amplitude gradient across the array of the noise field is negligible, that the array outputs are corrupted by additive wideband Gaussian independent sensor noises, and that the observation time is long. The Fisher Information Matrix is determined, and then used to show that the maximum likelihood estimate is asymptotically efficient (as theory dictates it should be). It is also shown that filtered correlator systems can provide asymptotically efficient estimates. Finally, the effects of suboptimal filtering of the inputs to a correlator system is investigated for the case when the signal and additive noise spectra are all band-limited and have constant slopes of 0, -3, or -6 db/octave. Dissert. Abstr.

N73-24178# Shape Air Defense Technical Center, The Hague (Netherlands). Communications Div.
IMPLICATIONS OF GROUND TERMINAL TYPE-TEST RESULTS ON NATO SATCOM PHASE 2 SYSTEM PERFORMANCE
H. Jaeger, R. A. Kennedy, and P. Murzi Oct. 1972 85 p refs
(STC-TM-332) Avail: NTIS HC $6.25

A description is given of the electrical characteristics of the satellites and the group terminals and theoretical calculations on overall performance. The detailed results of type-tests on the first (Euskirchen) terminal is compared with the contract specification. Many deficiencies are noted, and their probable effects on system performance are examined. It is concluded that several modifications are essential if the required system performance is to be attained. Author

N73-24179# Shape Air Defense Technical Center, The Hague (Netherlands).
A STUDY OF IMPULSIVE NOISE AND MEASUREMENTS IN THE VHF/UHF BAND

H. S. Oranc Oct. 1972 76 p refs
(STC-TM-340; Rept-9980) Avail: NTIS HC $6.00

The effects of vehicle ignition noise on the STC TACSATCOM terminal are studied. Curves are provided showing the noise amplitude distribution (NAD) under various conditions, and it is concluded that impulsive noise may be 30 db higher than carrier level for normal operation. The effects of ignition noise on the phase lock loop FM demodulator are also studied, and the system margin is found to be degraded by about 10 db. Author

N73-24180# Shape Air Defense Technical Center, The Hague (Netherlands). Mathematics and Computer Div.
THEORETICAL PREDICTION OF SPECTRAL PARAMETERS OF RADAR ECHOES FROM RAIN CLOUDS: MATHEMATICAL MODEL AND PROGRAM DESCRIPTION
J. Einbu Oct. 1972 50 p refs
(STC-TM-308) Avail: NTIS HC $4.50

A mathematical model is described. For simulating the reflection of radar signals from rain clouds. The emphasis is laid upon finding the velocity spectrum of rain clouds from which the mean and standard deviation of the Doppler speed can be determined. The model was programmed on the CDC 6400 computer at STC. All the factors influencing the shape of the velocity spectrum (e.g., antenna beam width, elevation angle, beam orientation, beam shape, wind profile, and location of the cloud) are under the control of the program user. Author

N73-24181# National Aviation Facilities Experimental Center, Atlantic City, N.J.
EVALUATION OF IMPROVED QUANTIZER DETECTOR MODIFICATION TO THE PRODUCTION COMMON DIGITIZER Interim Report, Dec. 1971 - Dec. 1972
Howard L. McFann and William C. Wanseen May 1973 55 p
(Proj. 121-107-020)
(FAA-RD-73-54) Avail: NTIS HC $4.75

A quantizer detector modification was installed in the production common digitizer AN/FYQ-47 located at the Elwood, New Jersey, National Aviation Facility Experimental Center long-range radar site. The purpose of the modification was to improve the search target detection capabilities of the digitizer, particularly in radar clutter environments. This was accomplished by providing adaptive feedback loops in the quantizer and improving the automatic clutter eliminator (ACE) logic circuitry. A series of element and subsystem tests were conducted to compile data for use in comparing the operational performance of the digitizer with and without the improved circuits. Test results indicate that the improved equipment effectively: maintains control of the noise probability over a 60 db radar log receiver dynamic range; increases target detection capability in clutter; and regulates false alarm rates resulting in a minimum activation of the ACE total blank functions. It was concluded that the modification significantly increased the see-through-clutter capability of the production common digitizer. Author

N73-24182# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
THEORY OF UHF AND MICROWAVE MEASUREMENTS USING THE POWER EQUATION CONCEPT
Glenn F. Engen Apr. 1973 68 p refs
(NBS-TN-637) Avail: SOD $0.70 as C13.46:637 CSCL 20N

Theoretical considerations indicate that UHF and microwave measurements based on the power equation concept should exhibit reduced sensitivity to certain connector imperfections. By assuming a phase detection capability it is possible to eliminate the tuning requirement. Author

N73-24183*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A NEW APPROACH TO TELEMETRY DATA PROCESSING Ph.D. Thesis - Maryland Univ.
Carlo Joseph Broglio May 1973 170 p refs
(NASA-TM-X-66248; X-522-73-135) Avail: NTIS HC $10.50 CSCL 09F

An approach for a preprocessing system for telemetry data processing was developed. The philosophy of the approach is the development of a preprocessing system to interface with the main processor and relieve it of the burden of stripping information from a telemetry data stream. To accomplish this task, a telemetry preprocessing language was developed. Also, a hardware device for implementing the operation of this lauguage was designed using a cellular logic module concept. In the development of the hardware device and the cellular logic module, a distributed form of control was implemented. This is accomplished by a technique of one-to-one intermodule communications and a set of privileged communication operations. By transferring this control state from module to module, the control function is dispersed through the system. A compiler for translating the preprocessing language statements into an operations table for the hardware device was also developed. Finally, to complete the system design and verify it, a simulator for the collular logic module was written using the APL/360 system. Author

N73-24184# Joint Publications Research Service, Arlington, Va.
COMMUNICATIONS IN THE NINTH FIVE YEAR PLAN
N. D. Psurtsev 7 Jun. 1973 47 p Transl. into ENGLISH of the book "Svyaz v Devyatiletke" Moscow, Svyaz, 8 Aug. 1972 71 p
(JPRS-59221) Avail: NTIS HC $4.50

The results of the eighth five-year plan in the field of communications are reported. Much attention is paid to treatment of new technical solutions which will provide the basis for development of various forms of communication: space radio-relay communication, telephony, telegraphy, the postal service, television and radio broadcasting, and dissemination of the press. Author

N73-24185# Institute for Telecommunication Sciences, Boulder, Colo.
COMPATIBILITY MEASUREMENTS OF DIGITAL MSK AND VOICE TRANSMISSIONS Final Report, Apr. 1972 - Apr. 1973
J. R. Jurosher Apr. 1973 96 p refs
(Contract DOT-FA72WAI-268)
(FAA-RD-73-63) Avail: NTIS HC $6.75

A series of experimental tests to measure interference between digital and voice systems are described. The digital system consisted of a 2400 bit-per-second, minimum-shift-keyed modem whose 1.2 and 2.4 kHz tones were transmitted by amplitude modulation. Measurements were made showing the effects of digital interference on voice transmission, voice interference on digital transmission, and digital interference on digital transmission. The tests were conducted at VHF using a commercial aircraft receiver. Also described is an experiment to frequency multiplex the MSK signal for simultaneous transmission with voice. Circuitry was developed to frequency translate the 1.2 and 2.4 kHz tones of the digital system to 6.6 and 7.8 kHz, respectively. Measurements were then conducted to demonstrate feasibility. Author

N73-24186# Computer Sciences Corp., Falls Church, Va.
FAA COMMUNICATIONS SYSTEM DESCRIPTION (1973) Final Report on Phase 1
J. C. Hansen, E. M. Boseck, R. Weber, and R. Lorence Washington FAA Feb. 1973 477 p refs
(Contract DOT-FA72WA-3072)
(FAA-RD-73-36) Avail: NTIS HC $26.00

The current operational communications employed by the FAA in supporting the National Aviation System is described. The evolution of FAA communications is presented as well as a summary of the primary information transfer. Detailed descriptions of all the major communication systems and subsystems are included. The report covers air-ground, ground-ground (voice) and ground-ground (data) communications. Author

N73-24187*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TELEMETRY PROCESSOR Patent Application
Leonard Erlichman (Wolf Res. and Develop. Corp.), Charles E. Mills (Wolf Res. and Develop. Corp.), Bruce R. Mancinelli (Wolf Res. and Develop. Corp.), William C. Webb, Peter A. Bracken, Robert A. Hoffman, Mark L. Stefurak, James L. Michael, and Murray L. Lavenstein, inventors (to NASA) Filed 15 Nov. 1972 80 p
(Contract NAS5-11735)
(NASA-Case-GSC-11388-1; US-Patent-Appl-SN-306980) Avail:

NTIS HC $6.00 CSCL 09F

A remote station derives a telemetry data stream by sampling data sources in response to a program derived from a programmable memory at the remote station. Most of the data sources are sampled in a predetermined order and indications of the values of the data sources are inserted into station stream without identifying the data source. At a local station responsive to the data stream, a replica of the program is synchronized to the data stream. After the program replica and data stream have been synchronized, data values from the data stream are extracted and identified as to data source in response to instructions from the program map. NASA

N73-24188*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.

THE INFLUENCE OF POLARIZATION ON MILLIMETER WAVE PROPAGATION THROUGH RAIN Semiannual Status Report, 1 Jul. - 31 Dec. 1972

Charles W. Bostian and W. L. Stutzman 1 Jan. 1973 42 p refs

(Grant NGR-47-004-091)

(NASA-CR-132074; SASR-2) Avail: NTIS HC $4.25 CSCL 20N

Measurement and analysis data on the depolarization and attenuation that occur when millimeter wave radio signals propagate through rain are reported. Author

N73-24189*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

APOLLO 15 MISSION. TEMPORARY LOSS OF COMMAND MODULE TELEVISION PICTURE Anomaly Report No. 4

Mar. 1973 9 p

(NASA-TM-X-69296; JSC-07912) Avail: NTIS HC $3.00 CSCL 17B

An investigation was made into the temporary loss of command module color television picture by the ground station converter at Mission Control Center. Results show the picture loss was caused by a false synchronization pulse that resulted from the inability of the black level clipping circuit to respond adequately to the video signal when bright sunlight suddenly entered the camera's field of view. Author

N73-24190# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

AUTOMATIC LASER TRACKING SYSTEM: DIGITAL CONTROL AND SIMULATION Ph.D. Thesis - Paris Univ.

Elie Haziza Sep. 1972 101 p refs In FRENCH; ENGLISH summary

(ONERA-NT-198) Avail: NTIS HC $7.25

The inputs are on the one hand the pointing error, quantified with only five possible values, and on the other hand the position of the turret, provided by optical encoders. The real time control program, writtern to minimize computation times, provides the target angular velocities, ensures the echo validation and takes into account a possible loss of echo. The simulation program permitted, after real tests, improvement of the control program, either by reducing the cost function, or by passing from first to second order the velocity error estimation. Author (ESRO)

N73-24191# System Research, Ltd., Richmond (England).

COOPERATIVE COMPUTING SYSTEMS FOR ECHO DETECTION WITH RESPECT TO MOVING TARGETS SUB PROJECT FEASIBILITY STUDY AND DEFINITION OF TASK RELEVANT PARAMETERS Final Scientific Report, 1 Mar. - 31 Aug. 1972

T. R. McKinnon Wood, Gordon Pask, and D. Kallikourdis 18 Nov. 1972 49 p refs

(Contract F44620-72-C-0054; AF Proj. 9767)

(AD-758266; EOAR-TR-72-01) Avail: NTIS CSCL 17/9

The report describes a feasibility of echo detection using a Cooperative Computing System (CCS) which has been used successfully in process control, signal filtering, classification, and pattern recognition. The technique is specifically applied to the identification of moving targets on AMTI radar and developments such as FLAMR and F-15 Radar. But the principles are also applicable to Sonar systems. (Author Modified Abstract) GRA

N73-24192# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.

IMPROVED WIDEBAND SCATTERING ANALYSIS Final Report

C. S. Liang and R. W. Clay Griffiss AFB, N. Y. RADC Jan. 1973 283 p refs

(Contract F30602-71-C-0217)

(AD-758245; FZE-1232; RADC-TR-73-11) Avail: NTIS CSCL 17/9

An analytical investigation was directed toward extending the frequency-domain theoretical techniques for the accurate derivation of transient backscattered signatures from selected satellite objects. High-frequency asymptotic methods were applied in the formulation of the scattered returns from five targets, and the corresponding short pulse signatures were ascertained by transforming the target frequency response weighted by the effective transmitted pulse spectrum. The computed results were compared both qualitatively and quantitatively with a large volume of measured model-range data, and the agreement was generally good. (Author Modified Abstract) GRA

N73-24193# Johns Hopkins Univ., Baltimore, Md. Dept. of Statistics.

STATISTICAL TECHNIQUES FOR COMMUNICATION, TRACKING AND CONTROL Summary Progress Report, 1 Aug. 1972 - 31 Jan. 1973

David B. Duncan Apr. 1973 24 p refs

(Contract F44620-72-C-0094; AF Proj. 9769)

(AD-758260; AFOSR-73-0538TR) Avail: NTIS CSCL 12/1

The research resulted in the preparation of eight papers to be submitted for publication. The areas of research include adaptive recursive trajectory estimation, linear dynamic recursive estimation, variance estimation, weak convergence of stochastic processes, analysis of binary time series, multiple comparisons, linear regression, and sampling theory. (Author Modified Abstract) GRA

N73-24194# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A MANUAL FOR A RADAR STATION OPERATOR

L. A. Fomin 28 Feb. 1973 273 p Transl. into ENGLISH of the publ. "Posobiye Operatora Radiolokatsionnoy Stantsii" Moscow, DOSAAF, 1970 p 1-235

(AD-758253; FTD-MT-24-1251-72) Avail: NTIS CSCL 17/9

The book deals with the design of meterband radar stations, presenting in a concise and easily understandable form basic information on radio, radar, electrical and pulse engineering, and setting forth the principal methods of operator activity under the conditions of a varying aerial situation. GRA

N73-24195# Michigan Univ., Ann Arbor. Systems Engineering Lab.

ON THE DESIGN OF A REMOTELY CONTROLLED INTELLIGENT TELEMETRY DEVICE

Donald W. Johnson Mar. 1973 116 p refs

(Contract DAAB07-72-C-0058; DA Proj. 1H0-62102-A-042)

(AD-758272; SEL-TR-68; Rept-010749-7-T; ECOM-0058-68) Avail: NTIS CSCL 09/6

A functional description and one possible hardward implementation are presented for a device whose function is the initiation and relaying of data messages. The device can be controlled, in terms of programmable parameters, remotely via communication channels. The three major components of the device are two transceivers and an elementary computer. The device, termed the Standard Telemetry Device in the report, is intended to serve as an interface between a transducer and communication channels in a surveillance, or data collection, network. For this reason surveillance networks are first considered from a systems point of view in order to better focus on problems which the Standard Telemetry Device can help overcome. Once this systems analysis has pointed up the particular problems which the device can help to solve, then a hardware configuration to implement such a device is presented. The report concludes with a rough estimate of the Standard Telemetry Device, based on the hardware configuration. Author (GRA)

N73-24196# IIT Research Inst., Chicago, Ill.

ELECTROMAGNETIC PULSE (EMP) HARDWARE Final

Report, 25 Jan. - 31 Oct. 1972
William C. Emberson Jan. 1973 69 p ref
(Contract DAHC20-72-C-0282)
(AD-758403) Avail: NTIS CSCL 17/2

The report presents the results of a study to determine the applicability and effectiveness of commercially available EMP protective devices for the hardening of typical Civil Defense communication systems against the EMP resulting from an exo-atmospheric nuclear burst. The study was limited to the rf side of communication equipments with operating frequencies in the range of 100 kHz-100 MHz. Representative EMP-induced transients are presented and used as general guidance for determining the effectiveness of the recommended hardening techniques. Author (GRA)

N73-24197# University of Southern Calif., Los Angeles.
EXPERIMENTS IN COMMUNICATION NETWORKS Technical Report, 1 Jan. - 31 Mar. 1973
G. M. Cady, B. P. Lientz, and N. E. Willmorth 31 Mar. 1973 31 p refs
(Contract N00014-67-A-0269-0027)
(AD-758098) Avail: NTIS CSCL 09/2

The document describes a computation oriented communications network where nodes representing computing centers and links are communication ties such as hard lines, microwave, or satellite. The parameters in such a network include the properties of hardware and software computation, communication links, and message traffic across the network. Such a system represents several government existing and proposed networks. The purpose of such a network is that reliability can be increased by providing rapidly accessed alternative centers and that cost effectiveness is gained through more efficient use of computer resources. GRA

N73-24198# IBM Watson Research Center, Yorktown Heights, N.Y.
ACOUSTO-OPTIC INTERACTIONS Final Report, 1 Jan. 31 Dec. 1972
E. G. Lean Feb. 1973 66 p refs
(Contract N00019-72-C-0241)
(AD-758719) Avail: NTIS CSCL 09/1

The document reports the results of the experimental and theoretical investigation of acousto-optic interactions in guided wave structure for optical modulation, deflection and signal processing applications. It includes a theoretical calculation of the diffraction efficiency between guided optical waves and acoustic surface waves and experimental results of isotropic and anisotropic diffraction in LiNbO3 and quartz. A simple acousto-optic plate modulator and electronically tunable acoustic-optic filter by acoustic surface waves has been demonstrated. The optical and acoustical properties of CVD ZnO films on sapphire, which may be needed for the acousto-optic devices in thin films are also included. Author (GRA)

N73-24199# Rice Univ., Houston, Tex. Dept. of Electrical Engineering.
OPTICAL COMMUNICATION SYSTEMS. REPORT OF A GRANTEE-USER MEETING
Thomas A. Rabson, ed. Jan. 1973 93 p refs Conf. held at Houston, Tex., 21 Sep. 1972 Sponsored by NSF
(PB-214778/3) Avail: NTIS HC $4.85 CSCL 17B

The report contains summaries of the talks presented by grantees at the optical communication group meeting. The papers are not limited just to laser technology and theory, but cover the range of optical communication technology. These include detection of infrared and weak images, materials, optical waveguides, as well as various wave-interaction phenomenon. A transcript of the general discussion between the 28 participants follows the summaries of the papers. Author (GRA)

N73-24200# Naval Underwater Systems Center, Newport, R.I.
WISCONSIN TEST FACILITY TRANSMITTING ANNTENA PATTERN AND STEERING MEASUREMENTS
Peter R. Bannister, Frederick J. Williams, Alan L. Dahlvig, and William A. Kraimer 13 Mar. 1973 52 p refs
(AD-758648; NUSC-TR-4395) Avail: NTIS CSCL 09/1

During August-September 1971 the Naval Underwater Systems Center (NUSC) performed pattern and steering measurements on the NS and EW antennas of the Wisconsin Test Facility (WTF). The pattern measurements were made at 13 different locations in eastern Minnesota and southern Wisconsin (covering approximately 120 degrees of arc); the farfield steering measurements were made in Mars Hill, Maine, and Swansboro, North Carolina. In order to ensure that the receiving sites were acceptable, approximately six components of the received magnetic field were measured at each site and then plotted on a normalized cosine curve. The 45- and 75-Hz pattern measurements were made at a range of approximately 300 km; for the steering measurements the range was 1.7 Mm. It was learned from the pattern and steering measurements that (1) the WTF EW antenna pattern is skewed clockwise, (2) the WTF NS antenna pattern is skewed counterclockwise, and (3) the effective conductivity under the WTF EW antenna is greater than that under the WTF NS antenna. Author (GRA)

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N73-24201# Advisory Group for Aerospace Research and Development, Paris (France).
GOVERNMENTAL ASSISTANCE FOR TECHNICAL INFORMATION IN INDUSTRY AND SIMPLE MECHANIZATION FOR SMALL INFORMATION CENTRES
Mar. 1973 99 p refs In ENGLISH partly in FRENCH Presented at the 25th Meeting of the AGARD Tech. Inform. Panel, Ankara, 23-24 Oct. 1972
(AGARD-CP-117) Avail: NTIS HC $7.00

The initiation and growth of small data centers and the problems of arranging them are summarized. Various forms and levels of information transfer to industry, from analysis and dissemination of summary reviews through visits to industry by technical information liaison personnel, to larger-scale nation wide dissemination to all interested firms, are discussed. For individual titles, see N73-24202 through N73-24212.

N73-24202 Advisory Group for Aerospace Research and Development, Paris (France).
INTRODUCTORY PAPERS: THE PRESENT STATE OF INFORMATION ACTIVITIES IN TURKEY AND FUTURE TRENDS
Kismet Burian (Scientific and Technical Research Council of Turkey) *In its* Governmental Assistance for Tech. Inform. in Ind. and Simple Mechanization for Small Inform. Centres Mar. 1973 4 p (For availability see N73-24201 15-08)

The state of the art of Turkey's information activities, as related to facilities and organizations of existing systems, are reported. Data are also given on TURDOK's role in designing a national information transfer system or network of systems to promote more effective and efficient execution of the national system. E.H.W.

N73-24203 SACLANT ASW Research Center, La Spezia (Italy).
ESTABLISHING SMALL INFORMATION CENTRES IN INDUSTRY
John P. Bethell *In* AGARD Governmental Assistance for Tech. Inform. in Ind. and Simple Mechanization for Small Inform. Centres Mar. 1973 7 p refs (For availability see N73-24201 15-08)

The function of a small information center in mediating between its community and the wider information network is explained, using the analogy of small medical centers. The differences between the information requirements of industry and those of science are emphasized and the desirability of clearly evaluating an industry's need for information before establishing an information center is indicated. Some of the specific duties of an industrial information center are described and it is stressed that these can now be most efficiently performed by requiring that the senior staff of the center have a broad education in information and its applications. It is recommended that the attitude of the center's staff and its organizational and physical location should be such as to maximize the center's orientation towards its users. Management is warned that some time must

elapse before an information center becomes fully effective.
Author

N73-24204 Royal Aircraft Establishment, Farnborough (England).
LIBRARY AND INFORMATION SERVICES AT THE ROYAL AIRCRAFT ESTABLISHMENT: SOME PROBLEMS AND THEIR PRESENT SOLUTIONS
R. C. Wright *In* AGARD Governmental Assistance for Tech. Inform. in Ind. and Simple Mechanization for Small Inform. Centres Mar. 1973 17 p (For availability see N73-24201 15-08)

Methods used to provide library and information services (more particularly information from books and journals) in a large research establishment (the services themselves being described in the Appendix) are outlined. Problems encountered in such an endeavor and present solutions to some of them are discussed.
Author

N73-24205 Ministry of Education and Sciences-Documentation Department, The Hague (Netherlands).
TRAINING OF PERSONNEL TO MAN THE VARIOUS PARTS OF AN INFORMATION CENTRE AND TO OPERATE VARIOUS KINDS OF SERVICE c05
W. F. DeRegt *In* AGARD Governmental Assistance for Tech. Inform. in Ind. and Simple Mechanization for Small Inform. Centres Mar. 1972 4 p (For availability see N73-24201 15-08)

The problems and primary aims of training personnel or staff for an information center are outlined. Educational objectives are formulated by which the sum total of attitudes, knowledge, and skills acquired by such personnel are defined: These objectives are also used to develop a suitable curriculum.
Author

N73-24206 Rome Air Development Center, Griffiss AFB, N.Y.
MICROFORMS: PRESENT ECONOMICS AND FUTURE USE
Fred S. Dyer *In* AGARD Governmental Assistance for Tech. Inform. in Ind. and Simple Mechanization for Small Inform. Centres Mar. 1973 6 p refs (For availability see N73-24201 15-08)

Basic microforms and their integration with machine processing to achieve highly versatile information systems are analyzed. Costs and future use of the integrated system are also discussed.
Author

N73-24207 Zentralstelle fuer Maschinelle Dokumentation (ZMD), Frankfurt (West Germany).
PROBLEMS OF DATA RECORDING AND DATA INTERCHANGE
Ruediger Bernhardt *In* AGARD Governmental Assistance for Tech. Inform. in Ind. and Simple Mechanization for Small Inform. Centres Mar. 1973 6 p refs (For availability see N73-24201 15-08)

Different data recording machines and their fonts of characters are outlined. Necessities and possibilities of structuring data are pointed out. Methods of checking and cleaning incorrect data are also mentioned. One of the possibilities of reducing the costs of data processing is the utilization of data interchange. Requirements concerning hardware and software for using interchange formats are explained.
Author

N73-24208 Advisory Group for Aerospace Research and Development, Paris (France).
INPUT SYSTEMS AND RESEARCH FOR SMALL DOCUMENTARY CENTERS [SYSTEMES D'ENTREES ET DE RECHERCHES POUR DES CENTRES DOCUMENTAIRES DE FAIBLE OU MOYENNE IMPORTANCE]
J. Klopp (CEDOCAR, Paris) *In its* Governmental Assistance for Tech. Inform. in Ind. and Simple Mechanization for Small Inform. Centres Mar. 1973 24 p refs In FRENCH (For availability see N73-24201 15-08)

Operating principles and types of data research centers are discussed. Data cover input systems, research format, data storage, automatic and mechanical research, and system classification.
Transl. by E.H.W.

N73-24209 Defence Scientific Information Service, Ottawa (Ontario).
PRESENTING A DEVELOPMENT PLAN FOR APPROVAL
A. C. Jones *In* AGARD Governmental Assistance for Tech. Inform. in Ind. and Simple Mechanization for Small Inform. Centres Mar. 1973 5 p refs (For availability see N73-24201 15-08)

The impact of various ways of presenting proposals for creating and developing a new information facility on higher management are reviewed. Some of the difficulties of establishing and presenting user needs are explored, and an analogy is offered on surveying of commodity marketing and salesmanship. Careful tailoring was made to the proposal to suit the management functions and facilitate evaluation. Suggestions are made on objective facility development and proposal merits.
Author

N73-24210 Defence Research Information Centre, Orpington (England).
TAILORED ABSTRACTS AND TECHNICAL DIGESTS: A SERVICE FOR INDUSTRY
S. C. Schuler *In* AGARD Governmental Assistance for Tech. Inform. in Ind. and Simple Mechanization for Small Inform. Centres Mar. 1973 9 p refs (For availability see N73-24201 15-08)

Three information services are described, each aiming to give a degree of selectivity in order to reduce the total amount of material a user must scan in order to obtain the information of use to him. The services are (a) the IEE Tailored Abstracts (TABs) which provide sections of the comprehensive IEE Abstracts journals as separate bulletins, (b) R and D Report Announcements issued by the UK DTI-TRC to give selective subject coverage in four separate bulletins derived from the comprehensive R and D Abstracts journal, and (c) the DTI Techlink service which provides one-page leaflets describing new materials, processes, techniques, etc., to individuals who have expressed an interest in the subject covered. The production and distribution of Techlinks are described in detail as the system can be used for the dissemination of various types of information.
Author

N73-24211 National Research Council of Canada, Ottawa (Ontario).
INFORMATION EXTENSION SERVICES FOR INDUSTRY
Gerard Kirouac *In* AGARD Governmental Assistance for Tech. Inform. in Ind. and Simple Mechanization for Small Inform. Centres Mar. 1973 4 p (For availability see N73-24201 15-08)

A brief description is given of the experience of the Technical Information Service of the NRCC. Data emphasize the vital part of the liaison engineer in transferring technological information to small and medium scale industry through three sections of this service: the equity and answer division, the industrial engineering group and the technological development program. Improvements for the benefit of countries interested in this approach are suggested.
Author

N73-24212* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE DEVELOPMENT AND USE OF A MODERN DATA BANK
Dudley G. McConnell *In* AGARD Governmental Assistance for Tech. Inform. in Ind. and Simple Mechanization for Small Inform. Centres Mar. 1973 8 p (For availability see N73-24201 15-08)
CSCL 09B

The modern data bank emphasizes immediate access by a user community which may be large in number, widespread, and having varied needs. Electronic computers have been found very useful in the processing of stored information. The key to the design of a data bank is the optimum mix of human intellectual effort and mechanized processing. The elements of the NASA data bank are presented as one approach to the many trade-off decisions involved in the development of a data bank and integrated information system.
Author

N73-24213*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMPUTER USER'S MANUAL FOR A GENERALIZED CURVE FIT AND PLOTTING PROGRAM
Ronald A. Schlagheck, B. D. Beadle, II, B. D. Dolerhie, Jr., and J. W. Owen 1 Jan. 1973 65 p
(NASA-TM-X-64744) Avail: NTIS HC $5.25 CSCL 09B

A FORTRAN coded program has been developed for generating plotted output graphs on 8-1/2 by 11-inch paper. The program is designed to be used by engineers, sceintists, and non-programming personnel on any IBM 1130 system that includes a 1627 plotter. The program has been written to provide a fast and efficient method of displaying plotted data without having to generate any additions. Various output options are

available to the program user for displaying data in four different types of formatted plots. These options include discrete linear, continuous, and histogram graphical outputs. The manual contains information about the use and operation of this program. A mathematical description of the least squares goodness of fit test is presented. A program listing is also included. Author

N73-24214*# Radio Corp. of America, Burlington, Mass. Advanced Technology Labs.
MULTIFUNCTION DISPLAY SYSTEM, VOLUME 1 Final Report
Feb. 1973 127 p 2 Vol.
(Contract NAS9-12008)
(NASA-CR-128934; DRD-MA-129TB-Vol-1) Avail: NTIS HC $8.50 CSCL 09B

The design and construction of a multifunction display man/machine interface for use with a 4 pi IBM-360 System are described. The system is capable of displaying superimposed volatile alphanumeric and graphical data on a 512 x 512 element plasma panel, and holographically stored multicolor archival information. The volatile data may be entered from a keyboard or by means of an I/O interface to the 360 system. A 2-page memory local to the display is provided for storing the entered data. The archival data is stored as a phase hologram on a vinyl tape strip. This data is accessible by means of a rapid transport system which responds to inputs provided by the I/O channel on the keyboard. As many as 500 frames may be stored on a tape strip for access in under 6 seconds. Author

N73-24215*# Radio Corp. of America, Burlington, Mass. Advanced Technology Lab.
MULTIFUNCTION DISPLAY SYSTEM, VOLUME 2: APPENDICES Final Report
Feb. 1973 64 p 2 Vol.
(Contract NAS9-12008)
(NASA-CR-128935; DRD-MA-129TB-Vol-2) Avail: NTIS HC $5.25 CSCL 09B
For abstract, see N73-24214

N73-24216*# Analytical Mechanics Associates, Inc., Seabrook, Md.
ADMAP (AUTOMATIC DATA MANIPULATION PROGRAM) Computer Program Utilization Report
F. I. Mann Jan. 1971 35 p refs
(Contract NAS5-11364)
(NASA-CR-130242; Rept-71-1) Avail: NTIS HC $3.75 CSCL 09B

Instructions are presented on the use of ADMAP, (automatic data manipulation program) an aerospace data manipulation computer program. The program was developed to aid in processing, reducing, plotting, and publishing electric propulsion trajectory data generated by the low thrust optimization program, HILTOP. The program has the option of generating SC4020 electric plots, and therefore requires the SC4020 routines to be available at excution time (even if not used). Several general routines are present, including a cubic spline interpolation routine, electric plotter dash line drawing routine, and single parameter and double parameter sorting routines. Many routines are tailored for the manipulation and plotting of electric propulsion data, including an automatic scale selection routine, an automatic curve labelling routine, and an automatic graph titling routine. Data are accepted from either punched cards or magnetic tape. Author

N73-24217*# Analytical Mechanics Associates, Inc., Seabrook, Md.
GLOBAL TRAJECTORY TARGETING VIA COMPUTER GRAPHICS
F. I. Mann Nov. 1971 11 p refs
(Contract NAS5-11364)
(NASA-CR-130241; Rept-71-39) Avail: NTIS HC $3.00 CSCL 09B

A technique is described in which the two-point boundary value problem (TPBVP) may be solved with the aid of interactive computer graphics. The particular TPBVP considered is the optimal electric propulsion space trajectory problem. An appropriate two-dimensional projection of the TPBVP mapping, or trajectory, is displayed on the computer's television screen, and a man-in-the-loop varies selected trajectory starting conditions in the fashion of a nonlinear walk until the viewed trajectory endpoint lies near a displayed target. Once global targeting is accomplished in this manner, program internal logic can easily handle local targeting to strongly solve the TPBVP. Author

N73-24218*# SCI Electronics, Inc., Huntsville, Ala. Special Projects Section.
DIGITAL CAPACITANCE MEASURING SYSTEM Final Report
Mar. 1973 121 p
(Contract NAS8-27657)
(Rept-2873-2143-116; NASA-CR-124246) Avail: NTIS HC $8.25 CSCL 09B

The hardware phase of a digital capacitance measuring system is presented with the major emphasis placed on the electrical design and operation. Test results are included of the three units fabricated. The system's interface is, applicable to existing requirements for the space shuttle vehicle. J.M.M.

N73-24219*# Illinois Univ., Urbana. Ionosphere Radio Lab.
A SLOW-SPEED MULTIPLE-CHANNEL ANALOG-TO-DIGITAL DATA LOGGING SYSTEM
T. C. Lloyd and B. J. Flaherty Apr. 1973 186 p refs
(Grant NGR-14-005-002)
(NASA-CR-132954; TR-49; UILU-ENG-73-2548) Avail: NTIS HC $11.50 CSCL 09B

The system was developed to record from one up to a maximum of sixteen channels of analog data onto magnetic tape. Each analog channel of data can be sampled at rates of 1, 2, 6, 12, or 60 times per minute. The system is divided into three subunits: a digital clock, an incremental magnetic tape recorder, and a sequential converter. The interfacing requirements of these subunits are presented. Author

N73-24220# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
STUDY OF PERFORMANCES OF SPATIAL FREQUENCY FILTERING AND COHERENT OPTICS Annual Report [ETUDE DES POSSIBILITIES DU FILTRAGE DES FREQUENCES SPATIALES ET DE L'OPTIQUE COHERENTE RAPPORT ANNUEL D'ACTIVITE]
LeCarvennec 31 Dec. 1971 8 p In FRENCH
(Contract DGRST-70-02-184-00-212-75-01)
(LCR-DR-1-71-253/1/R) Avail: NTIS HC $3.00

In connection with optical data processing, spatial filtering was applied to coherent light. A total reflection prism was found useful, but limited to a certain data format. Other solutions, such as utilization of diffusion phenomena of liquid crystals, are not applicable to a coherent light system. So far, the data input problem has not yet been resolved. Other possible solutions may be found by using the birefringence of liquid crystals, or possible to define the characteristics of the lenses which can be accomplished using different technologies. ESRO

N73-24221# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
EVALUATION OF THE USE OF AN ASSOCIATIVE PROCESSOR IN COMMUNICATION MULTIPLEXING Final Report, Jul. 1971 - Aug. 1972
L. D. Wald, T. R. Armstrong, C. C. Huang, and T. L. Saxton
Griffiss AFB, N. Y. RADC Feb. 1973 211 p refs
(Contract F30602-71-C-0350)
(AD-758246; Z9506-3022; RADC-TR-71-19) Avail: NTIS CSCL 09/2

The use of associative processing for voice compression, data concentration, and asynchronous multiplexing onto a high-speed transmission facility was investigated. An Associative Communication Multiplexer (ACM) incorporating an associative processor architecture suitable for implementation of time domain redundancy reduction algorithms was designed and evaluated. A computer simulation of the ACM was designed to enable speech quality comparisons to be made with actual voice processed by several candidate algorithms. This program simulated the ACM operations of voice digitization, compression, selection of most significant samples for transmission, and reconstruction of analog waveforms. The ACM system organization, operation, and implementation are described along with a presentation of the

design tradeoff studies and system requirements for a 256 channel system with both voice and digital data inputs. (Author Modified Abstract) GRA

N73-24222# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
AN EVALUATION OF TEN FAST FOURIER TRANSFORM (FFT) PROGRAMS
Harry W. Maynard Mar. 1973 50 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-758451; ECOM-5476) Avail: NTIS CSCL 09/2

The fast Fourier transform (FFT) algorithm is a very efficient method for computing very large Fourier transforms and is now a valuable tool for analyses of meteorological and other geophysical data. The algorithm is a scheme for very rapid numerical computation of a finite, discrete Fourier transform on a digital computer. A number of computer programs have been written to implement the FFT algorithm. Ten such programs, written in the FORTRAN language, were tested in order to select one which would be the most suitable for the analysis of turbulence and related data. Criteria for evaluation were accuracy, execution time (speed), computer memory required, and versatility. A program designated here as FFT7 was chosen as the best of those tested for use as an operational FFT program. (Author Modified Abstract) GRA

N73-24223# Naval Postgraduate School, Monterey, Calif. Dept. of Electrical Engineering.
INTERACTIVE DIGITAL PROCESSING OF OPTICAL DATA M.S. Thesis
John Stephen Craig Dec. 1972 45 p refs
(AD-758517) Avail: NTIS CSCL 09/2

Interactive digital processing of optical data is shown to be useful in investigations of pattern recognition techniques. A system including a flying spot scanner and graphics terminal for the optical to digital conversion and subsequent display of two-dimensional images is described. Application of such a system is demonstrated by interactive contour tracing and character recognition by template matching. Algorithms necessary for the applications are developed and tested. Author (GRA)

N73-24224# Carnegie-Mellon Univ., Pittsburgh, Pa.
OPTICAL COMPUTING SYSTEMS
Sing H. Lee Dec. 1972 38 p refs Workshop held at Pittsburgh, 14-15 Sep. 1972
(Grant NSF GK-35361)
(PB-214573/8) Avail: NTIS HC $3.75 CSCL 09B

The workshop brought together those people who are engaged in optical computer research to obtain a better understanding of the present and future needs of optical computing systems. This was accomplished through the interchange of ideas about the possibilities for application of the greater speed and capacity potential of these systems. The panel concluded that presently there is a need for research in optical input devices. Future research should be directed to encoding data, nonlinear and space-variant optical components, and to optical digital logic. Author (GRA)

N73-24983 European Space Research and Technology Center, Noordwijk (Netherlands).
DATA PROCESSING IN PROJECT CONTROL
P. R. Knight *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 241-258 (For availability see N73-24962 15-34)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N73-24225 National Lending Library for Science and Technology, Boston Spa (England).
TELEVISION SETS USED AS DISPLAY READOUT DEVICES
R. Zimmerman 9 Apr. 1973 19 p refs Transl. into ENGLISH from NTZ (Berlin), v. 25, no. 5, 1972 p K93-K99
(NLL-PO-2958-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Conventional television sets are suitable for display readout devices of display units. On account of the fixed line number of the video frame and due to the limited bandwidth, the number of characters presentable on the screen is narrowed but sufficient for most applications. In addition to characters and symbols also curves and diagrams may be displayed in a simple manner. Television sets in opposition to other types of readout devices make possible colored displaying, blending in of half-tone pictures (from cameras, scanners, videotape recorders), and simple recording of such mixed pictures. A universal display unit developed recently is reported and its characteristics are explained with block diagrams and applications. Author

N73-24226 National Lending Library for Science and Technology, Boston Spa (England).
THE RELATIONSHIP BETWEEN THE INITIAL DWELL AND TRAVEL OF SWITCHING ARCS AND THEIR CATHODE MECHANISM
G. Burkhard 8 Feb. 1973 11 p refs Transl. into ENGLISH from Elektrie (West Germany), v. 24, no. 1, Jan. 1970 p 1-4
(NLL-CE-Trans-6108-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Eng.: 1 NLL photocopy coupon

It is shown that short dwell times and high arc travel speeds are necessary to minimize contact erosion between electrodes. The two phenomena are explained with reference to the emission mechanism of arc discharge. Author

N73-24227 National Lending Library for Science and Technology, Boston Spa (England).
PULSE-SHAPE AND AMPLIFICATION OF PROPORTIONAL COUNTER PULSES WITH AMPLIFIERS OF LIMITED BAND-WIDTH
H. Erlenkeuser 5 Feb. 1973 9 p refs Transl. into ENGLISH from Atomkernenergie (Munich), v. 15, no. 3, 1970 p 235-238
(NLL-WH-Trans-343-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The pulse shape and pulse height of a proportional counter depend not only on the gas amplification, but also on the velocity with which the positive ions of the gas amplification are drifting from the counter wire. This velocity is a function of the high voltage. Thus both the height of the counter pulse and also the gain factor of a frequency limited amplifier vary with counter voltage independently of gas amplification. Both effects are computed. The order of magnitude is a few percent. The dependence of gain factor on bandwidth is given. The parameters and results are expressed in a generalized form and can be applied to all counter devices under consideration. Author

N73-24228 National Lending Library for Science and Technology, Boston Spa (England).
INCREASE IN RESOLUTION POWER OF CAMERA TUBES
Ya. A. Ryftin and V. M. Myasnikov 12 Mar. 1973 16 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), v. 8, Aug. 1972 p 37-42
(NLL-DRIC-Trans-3025-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Techniques for increasing the resolving of camera tubes without increasing the overall dimensions are discussed. The subjects involved are: (1) distribution of electron density in the switching beam, (2) improvement in electron density in the beam, and (3) improvements in the characteristics of lateral scanning. It is concluded that the transition from a small round aperture opening to a suitably large square one is the simplest and most effective means of increasing the resolving power of transmission tubes. Author

N73-24229 Stanford Univ., Calif.
MONOLITHIC ACOUSTIC SURFACE WAVE AMPLIFIERS Ph.D. Thesis
Larry Allen Coldren 1972 189 p
Avail: Univ. Microfilms Order No. 72-30611

The fabrication and characterization of monolithic acoustic surface wave amplifiers are discussed. These devices employ the interaction between carriers drifting in a semiconductor and electric fields traveling with an acoustic surface wave on a

piezoelectric delay line. The theoretical characteristics of such an amplifier are reviewed, and the results of existing theories are simplified into a more useable form. The noise figure for this device is derived from a normal mode theory. New theoretical approaches are given for different configurations which involve two semiconductor films or a semiconductor coupled to the acoustic beam via metal electrodes. Dissert. Abstr.

N73-24230 Polytechnic Inst. of Brooklyn, N.Y.
THE NOISE PROPERTIES AND MEASUREMENTS OF A MILLIMETER GAS PARAMETRIC AMPLIFIER Ph.D. Thesis
Robert Thomas Kihm 1972 79 p
Avail: Univ. Microfilms Order No. 72-28251

A gas parametric amplifier, operating at 140 GHz was designed, constructed and tested. A gain of better than 20 db was achieved and a noise figure of approximately 25 db was measured. At room temperature operation, the amplifier has a theoretical noise figure of 8 db. The source of this noise is predominantly spontaneous emission by the molecules of the gas, DCN-15 which is the active medium of the amplifier. The spontaneous emission cannot be computed by Einstein's A coefficient since the energy levels of interest of the molecular system are not in thermal equilibrium, but driven by a large monochromatic pump. The discrepancy between the measured and theoretical noise figures is attributed to phase fluctuation noise of the klystron oscillator pumping the medium. Analysis has shown that phase fluctuations of the pump field can affect the active medium properties such that amplitude fluctuations result at the amplifier's output. Circuits were analyzed and assembled to cancel this noise. Dissert. Abstr.

N73-24231*# AiResearch Mfg. Co., Los Angeles, Calif.
ENVIRONMENTAL CONTROL SYSTEM TRANSDUCER DEVELOPMENT STUDY Final Report
M. J. Brudnicki 10 Feb. 1973 431 p
(Contract NAS9-12452)
(NASA-CR-128921; Rept-72-8537-1) Avail: NTIS HC $23.75 CSCL 09A

A failure evaluation of the transducers used in the environmental control systems of the Apollo command service module, lunar module, and portable life support system is presented in matrix form for several generic categories of transducers to enable identification of chronic failure modes. Transducer vendors were contacted and asked to supply detailed information. The evaluation data generated for each category of transducer were compiled and published in failure design evaluation reports. The evaluation reports also present a review of the failure and design data for the transducers and suggest both design criteria to improve reliability of the transducers and, where necessary, design concepts for required redesign of the transducers. Remedial designs were implemented on a family of pressure transducers and on the oxygen flow transducer. The design concepts were subjected to analysis, breadboard fabrication, and verification testing. Author

N73-24232# National Aerospace Lab., Tokyo (Japan).
STUDY OF THE SYNCHRONIZING CONTROL OF A DRAG-CUP GYRO MOTOR
Hiroshi Yamada 1972 19 p refs In JAPANESE; ENGLISH summary
(NAL-TR-304) Avail: NTIS HC $3.00

A study is reported of the synchronizing control of a drag-cup gyro motor using a dynamic gas bearing. The drag-cup induction motor as the gyro motor imparts a smoother torque and smaller noise characteristics than those found in hysteresis motors, but the motor has to have a synchronizing control system for keeping the rotor speed constant. This synchronizing control system consists of a speed control loop for bringing the rotor speed to a synchronizing speed and for giving damping to the rotor, and a phase-lock control loop for synchronizing the rotor phase to the phase of the reference oscillator. The speed control loop employs a frequency discriminator using an active band-pass filter, and the phase-lock control loop is equipped with a phase-sensitive detector using a gate circuit. The principle of operation of the synchronizing control system is described, and the analysis of the dynamic characteristics of components composing the loops is given, along with the comparison between the theoretical and experimental results. The dynamic responses of the components are analyzed by the AC carrier control theorem based on frequency and amplitude modulations. The theoretical results agreed well with the experimental results. Author

N73-24233*# Radio Corp. of America, Princeton, N.J.
CATHODOCHROMIC CATHODE RAY TUBE: AN OPERATIONS MANUAL Final Report, Feb. 1971 - Apr. 1972
Philip M. Heyman May 1972 64 p refs
(Contract NAS5-20231)
(NASA-CR-130236; PRRL-72-CR-19) Avail: NTIS HC $5.25 CSCL 09A

A cathodochromic (CC) storage and display system capable of storing full TV resolution images has been built. The images are derived from standard TV signals: composite video, composite sync, composite blanking, horizontal drive, and vertical drive. Image storage takes place in the CC CRT; the fixed image is written for several TV frames for the contrast to be usable. Once stored on the CC CRT, the image can be read out in one of three modes: with the eye, a 35-mm camera, or a TV camera. Incoming information may also be stored in a storage tube similar to the CC CRT but with a phosphor layer behind the CC layer. By exciting the phosphor layer with a standard raster scan it is possible to read out an image stored in the CC layer in one of three modes: direct viewing, photography, or flying-spot readout using a photomultiplier. Author

N73-24234*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN AND FLIGHT PERFORMANCE EVALUATION OF THE MARINERS 6, 7, AND 9 SHORT-CIRCUIT CURRENT, OPEN-CIRCUIT VOLTAGE TRANSDUCERS
Robert E. Patterson 15 Apr. 1973 51 p ref
(Contract NAS7-100)
(NASA-CR-132250; JPL-TM-33-603) Avail: NTIS HC $4.75 CSCL 09A

The purpose of the short-circuit voltage transducer is to provide engineering data to aid the evaluation of array performance during flight. The design, fabrication, calibration, and in-flight performance of the transducers onboard the Mariner 6, 7 and 9 spacecrafts are described. No significant differences were observed in the in-flight electrical performance of the three transducers. The transducers did experience significant losses due to coverslides or adhesive darkening, increased surface reflection, or spectral shifts within coverslide assembly. Mariner 6, 7 and 9 transducers showed non-cell current degradations of 3-1/2%, 3%, and 4%, respectively at Mars encounter and 6%, 3%, and 4-12%, respectively at end of mission. Mariner 9 solar Array Test 2 showed 3-12% current degradation while the transducer showed 4-12% degradation. Author

N73-24235*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEVELOPMENT OF A HYBRID MICROELECTRONICS SOLID STATE RELAY FOR 2500 VOLTS ISOLATION AND MINUS 120 C TO 80 C THERMAL CYCLING RANGE
B. L. Sater, T. J. Riley, and Wm. Janssen (Sterer Eng. and Manufacturing Co.) 1973 12 p refs Presented at Power Electronics Specialists Conf., Pasadena, Calif., 11-13 Jun. 1973; sponsored by Inst. of Elec. and Electronics Engr.
(NASA-TM-X-68248; E-7503) Avail: NTIS HC $3.00 CSCL 09A

A hybrid microelectronics solid state relay was developed in a TO-116 package for the MINX project. The relay provides 2500 Vdc input to output isolation and operated from a MHTL logic signal to switch a load of 400 Vdc at 2 mA. The relay is designed to operate in space and survive 1000 thermal cycles of 120 C to 80 C. The use of X-rays for failure analysis in small hybrid circuits proved valuable and the applications of vacuum deposited Parylene as a dielectric coating proved extremely valuable. Author

N73-24236*# National Academy of Sciences - National Research Council, Washington, D.C.
INTEGRABLE POWER GYRATOR Patent Application
Erwin S. Hochmair, inventor (to NASA) Filed 18 May 1973 25 p Sponsored by NASA
(NASA-Case-MFS-22342-1; US-Patent-Appl-SN-361666) Avail: NTIS HC $3.25 CSCL 09E

A gyrator circuit operable at high power levels is reported that contains two amplifiers in a circular loop: one produces

zero phase shift and the other 180 degree phase reversal. The output of each of the differential amplifiers is connected to the junction of two transistors so that output operation is class B. Each of the complementary transistors is connected to control two transistors in parallel by resistance circuit connected as an input signal to one of the differential amplifiers. NASA

N73-24237# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
COMPARATIVE STUDY OF dc AMPLIFIERS: CARY 401, KEITHLEY 610, KEITHLEY 640, VICTOREEN 5100
M. Hilaire, P. Redon, and J. P. Brethon Nov. 1972 45 p refs In FRENCH
(CEA-N-1580) Avail: AEC Depository Libraries

The sensitivity, reliability, drift, and accuracy of dc amplifiers were tested in view of application in radiation metrology. NSA

N73-24238# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
GUNN EFFECT WITHOUT DOMAIN IN SHORT SAMPLES Annual Report [EFFET GUNN SANS DOMAINE EN ECHANTILLONS COURTS RAPPORT ANNUEL]
P. C. Moutou Dec. 1971 10 p In FRENCH
(Contract DGRST-70-7-2334-00-221-75-01)
Avail: NTIS HC $3.00

The possibilities of applying the short domainless limited space charge accumulation (LSA) mode to Gunn oscillators was investigated, the objective being to obtain a microwave output power of 100 W for decimeter waves. Several samples of epitaxial material were tested for frequencies between 4 and 5 GHz, but were found unsatisfactory. The effect of impurity gradients on the performance of Gunn oscillators in short LSA mode was investigated, but results are not yet available. The problems of realizing the oscillator are surveyed. They include: (1) specification of the materials, (2) contacts, (3) series production, and (4) the microwave circuits. ESRO

N73-24239# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
STUDY AND DEVELOPMENT OF TWO BREADBOARD MODELS OF 0.5 TO 7.5 MICROSECOND ACOUSTIC DELAY LINES Final Report [ETUDE ET REALISATION DE DEUX MAQUETTES DE LIGNES A RETARD ACOUSTIQUE DE 0.5 ET 7.5 MICROSECONDES RAPPORT FINAL]
P. Defranould 22 Sep. 1971 29 p refs In FRENCH
(Contract STCAN-71.82.037.00.405.75.78)
Avail: NTIS HC $3.50

Two prototypes of acoustic delay lines with delays of 0.5 and 7.5 microseconds were investigated with a view to enlarging passbands and echo suppression. The frequency range used was between 1200 and 1800 MHz, and a triple trajectory was used to provide the necessary delay. With broadband transducers, it is possible to achieve a passband at 3 db equal to 1000 MHz, between 1 and 2 GHz, but the suppression of parasitic echoes has shown that it is difficult to maintain an echo level of -17db for short delay lines. ESRO

N73-24240# Radio Corp. of America, Princeton, N.J.
SCHOTTKY BARRIER DIODES FOR ELECTRON BEAM SEMICONDUCTOR APPLICATIONS Final Report, 1 Oct. 1971 - 30 Sep. 1972
Wieslaw W. Siekanowicz, Ho-Chung Huang, Ronald E. Enstrom, Ramon U. Martinelli, and Samuel Ponczak Dec. 1972 92 p refs
(Contract N00014-72-C-0151; NR Proj. 251-004)
(AD-757749) Avail: NTIS CSCL 09/1

Experimental and theoretical studies show that the current-gain and frequency response of electron-beam-semiconductor Schottky barrier diodes are better than those of pn junctions. The lower gain of the latter devices is attributed to recombination losses in the p- layer. High current gains (about 1500) were measured for silicon, gallium arsenide, and gallium arsenide phosphide Schottky diodes. Theoretical amplifier designs, based on measured current-gain characteristics, have shown that gallium arsenide phosphide does not provide significant improvements of gain linearity or efficiency over silicon. Gallium arsenide offers substantial increases of bandwidth over silicon and is less susceptible to deterioration resulting from temperature cycling and beam bombardment. Therefore, further development of gallium arsenide electron-beam-semiconductor targets is recommended. Author (GRA)

N73-24241# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.
ADVANCED CONCEPTS OF MICROWAVE GENERATION AND CONTROL IN SOLIDS Quarterly Technical Report, 1 Jul. - 30 Sep. 1972
G. C. Dalman, L. F. Eastman, C. A. Lee, and J. Frey Griffiss AFB, N. Y. RADC Jan. 1973 164 p refs
(Contract F30602-71-C-0010)
(AD-758244; RADC-TR-72-351; QTR-8) Avail: NTIS CSCL 09/1

The report deals with the progress made during the eighth quarterly period of a solid state microwave oscillator and amplifier research and development program. Included are the results of studies of transferred electron, punch-through injection, and avalanche diodes and solid state materials. Discussed first are a summary of LSA diode and circuit research at Cornell, research on thin LSA devices, a PCM Gunn oscillator, and InP materials studies. Next discussed are high average power TRAPATT diode structures, research on GaAs Schottky barrier avalanche diodes and research on high frequency TRAPATT oscillators. Also reported are two studies of punch-through injection (Baritt) diodes, one for high frequency CW operation and the other for low frequency CW operation. Work on microwave transistors is reported along with a review of progress, on an oscillator power combiner and IMPATT diode reflection amplifier. The report concludes with a discussion of the progress made on ion implantation, on vacuum epitaxial growth in silicon on ionization rates in GaAs, and on a microwave monolithic integrated circuit study. Author (GRA)

N73-24242# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AN INVESTIGATION OF SOME SLOW WAVE CONICAL LOG-SPIRAL AND HELICAL ANTENNAS Final Report, 1 Sep. 1971 - 31 Aug. 1972
John D. Dyson (Ill. Univ., Urbana) Nov. 1973 96 p refs
(Contract F19628-70-C-0230)
(AD-757913; ESD-TR-72-365; UILU-ENG-73-2542; UIAL-73-1)
Avail: NTIS CSCL 09/5

The first part of the report is concerned with the characteristics of conical spiral antennas constructed with zig-zag, i.e., slow-wave geometry, arms. This construction permits a reduction in size of approximately 15 percent below that required for the conventional antenna. It also increases the pattern beamwidth and lowers the characteristic impedance. In part 2, a 2 1/4-turn monofilar conical helix, fed at the base of the cone against an inner metal core, was investigated. This small circumference (approximately 1/4 wavelength) antenna can be made to be an axial radiating structure, while the conventional helix of this size radiates a maximum of energy broadside to the antenna axis. Author (GRA)

N73-24243# Aerospace Corp., El Segundo, Calif. Lab. Operations.
COMPARISON OF THE DETECTIVITIES OF A P-N PHOTOEMISSION DIODE UNDER BACKGROUND-LIMITED CONDITIONS Technical Report, Jan. - Jun. 1972
David H. Seib 9 Oct. 1972 34 p refs
(Contract F04701-72-C-0073)
(AD-757873; TR-0073(9230-20)-3; SAMSO-TR-73-84) Avail: NTIS CSCL 17/5

The background-limited detectivities of ideal Schottky internal photoemission diodes and p-n junction diodes are compared over the wavelength range 1 to 10 micrometers. The Schottky internal photoemission diode is found to have a detectivity one to two orders of magnitude less than the p-n junction device. The detectivities of the two detectors under nonbackground-limited conditions are also compared, and a brief discussion of the functional form of the quantum yield for the Schottky device is given. Author (GRA)

N73-24244# Aerospace Corp., El Segundo, Calif. Lab. Operations.
A SCANNED FLUSH-MOUNTED MULTIMODE SLOT ANTENNA Technical Report, Aug. - Oct. 1970

Jinny L. Wong, Howard E. King, and Robert B. Dybal 31 Jan. 1973 20 p refs
(Contract F04701-72-C-0073)
(AD-757907; TR-0073(3230-40)-1; SAMSO-TR-73-101) Avail: NTIS CSCL 09/5

The report describes the electrical characteristics of a multimode slot antenna that has a scan capability. The antenna consists of a rectangular slot with a one-wavelength aperture, excited with an offset probe, that couples energy into the desired TE sub (10) and TE sub (20) rectangular waveguide modes. This combination of modes produces a beam that is tilted from the slot broadside. The resultant beamwidth is narrower than that of a comparable slot excited in the dominant mode. The beam shape and scan angle depend on operating frequency and relative excitation of the two modes. A slot was mounted axially on a circular cylinder, and pattern, gain, and VSWR measurements were performed at L/S band frequencies for both air-filled and dielectrically loaded configurations. Author (GRA)

N73-24245# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.
BROADBAND TRANSMITTER TUBE Triannual Report, Jul. - Oct. 1972
M. K. Scherba Mar. 1973 32 p
(Contract DAAB07-72-C-0294)
(AD-758458; EDD-W-5262-1; ECOM-0294-1-72) Avail: NTIS CSCL 09/1

Cold test data was taken for various dual-helix circuit structures. Impedance, phase velocity and dielectric loading factor were measured for different circuit geometries at two different values of conductive shield to helix radius ratio. Dual beam electron gun design studies were performed. An electrolytic tank was used to determine the initial gun design. Electron trajectories along with beam characteristics were evaluated using a digital computer program. Both single beam and dual beam experimental electron guns were designed. (Author Modified Abstract) GRA

N73-24246# Naval Air Development Center, Warminster, Pa. Aero-Electronic Technology Dept.
PERFORMANCE OF A PHILIPS LABORATORIES ELECTRON BOMBARDED SILICON CAMERA TUBE
S. B. Campana 12 Mar. 1973 48 p refs
(AD-758360; NADC-72158) Avail: NTIS CSCL 09/1

Tests were made on a Philips 25 mm electron bombarded silicon tube which included photocathode sensitivity, dark current, square wave response, signal transfer, image lag, point source image spreading, limiting resolution, and image quality. (Author Modified Abstract) GRA

N73-24247# Army Electronics Command, Fort Monmouth, N.J.
A VERSATILE PROGRAMER FOR THE HEWLETT-PACKARD 6130B DIGITAL VOLTAGE SOURCE
Vincent J. Organic Mar. 1973 23 p refs
(DA Proj. 1S6-62705-A-440)
(AD-758212; ECOM-4098) Avail: NTIS CSCL 09/5

A digital programer has been designed and fabricated to generate digital input data for the Hewlett-Packard 6130B Digital Voltage Source (DVS). The programer is capable of producing approximate sawtooth and triangle waveforms from the DVS by repetitively stepping the output voltage in 1 or 10 mV increments. Pulse waveforms and dc voltages can also be generated. A functional description of the programer electronics is given in this report. Author (GRA)

N73-24248# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
SOME PROPERTIES OF AN INJECTION LOCKED PULSED MAGNETRON Physical Sciences Research Papers
Peter A. DeVito 16 Jan. 1973 26 p refs
(AF Proj. IL1R)
(AD-758198; AFCRL-TR-73-0073; AFCRL-PSRP-530) Avail: NTIS CSCL 09/1

The paper describes injection-locking of positive-pulse microwave magnetrons by a stabilized low power source. A coherent echo-detection system using an acoustic delay medium to simulate radar pulse return is employed to study phase coherence of injection-locked positive-pulsed magnetrons. Pulse-to-pulse coherence at approximately 9 GHz is observed for extremely low input powers: the maximum output to input ratio-for which such locking is observed-is about 10,000. (Author Modified Abstract) GRA

N73-24249# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.
ANALYTICAL AND COMPUTER DESIGN OF ARRAY ANTENNAS AND ANALYSIS AND SYNTHESIS OF ELECTROMAGNETIC SCATTERING SYSTEMS Final Report, 1 Feb. 1968 - 31 Dec. 1972
Bradley J. Strait and Roger F. Harrington 31 Jan. 1973 35 p refs
(Contract F19628-68-C-0180; AF Proj. 5635)
(AD-758768; AFCRL-TR-73-0080) Avail: NTIS CSCL 09/5

The report is the final report for Contract No. F19628-68-C-0180 which consisted of two line items: analytical and computer design of array antennas, and analysis and synthesis of electromagnetic scattering systems. The objective of this project was to develop analytical and computer design techniques for wire antennas, arrays, and radar scatterers. Consideration was given to synthesis and optimization techniques for both loaded and unloaded bodies. Both near fields and far fields of antennas and scatterers were investigated. A number of user-oriented computer programs were developed for wire objects and for bodies of revolution. A list of all technical reports, with abstracts, and of papers and talks related to this project, is included. (Author Modified Abstract) GRA

N73-24250# Ohio State Univ., Columbus. ElectroScience Lab.
POWER INVERSION IN A TWO ELEMENT ADAPTIVE ARRAY Final Technical Report
C. W. Schwegman and R. T. Compton, Jr. Dec. 1972 41 p refs
(Contract N00019-72-C-0184)
(AD-758690; ESL-3433-3) Avail: NTIS CSCL 09/5

The objective of this research is to develop an antenna system capable of receiving a weak communication signal in the presence of a strong interfering signal without the need for information about signal structure. This report considers the behavior of a two element adaptive array with proportional plus integral feedback control. Two incoherent CW signals (one desired and one interfering) are assumed incident on the array, and the improvement in signal-to-interference ratio is studied. Author (GRA)

N73-24251# Aerospace Corp., El Segundo, Calif.
DESIGN VARIATIONS AND PERFORMANCE CHARACTERISTICS OF THE OPEN-SLEEVE DIPOLE Technical Report, Mar. - Sep. 1972
Jimmy L. Wong and Howard E. King 15 Jan. 1973 40 p refs
(Contract F04701-72-C-0073)
(AD-758755; TR-0073(3404)-2; SAMSO-TR-73-133) Avail: NTIS CSCL 09/5

A detailed study has been made of the broadband characteristics of a balunfed, open-sleeve dipole mounted in front of a metallic reflector. VSWR and pattern measurements were performed in the UHF band for a variety of dipole-sleeve arrangements. Multiple cylindrical-rod sleeves and flat sleeves of disc and Greek-cross shapes were experimentally evaluated. Gain data were obtained on a crossed dipole with a tick-tack-toe sleeve configuration. It is shown that, with a proper choice of sleeve parameters, the dipole can be operated over a bandwidth of over an octave with a voltage standing wave ratio (VSWR) of less than 2:1. Author (GRA)

N73-24252# Naval Postgraduate School, Monterey, Calif. Dept. of Electrical Engineering.
AN INVESTIGATION INTO THE CHARACTERISTICS OF THE EDGE MOUNTED COAXIAL TEM-LINE ANTENNA M.S. Thesis
Dale Edward Schultz Dec. 1972 66 p refs
(AD-758518) Avail: NTIS CSCL 09/5

The edge mounted TEM-line antenna is a lightweight, low profile, medium-gain UHF-VHF traveling wave antenna. The antenna is capable of operating in several different modes in a given frequency band. In its simplest form the antenna consists of a small diameter semi-rigid coaxial transmission line bonded

to the edge of a conducting ground plane. Sections of the coax outer conductor are removed at periodic intervals to form the radiating elements. The paper presents methods of measuring and calculating the characteristic impedance and discontinuity capacitance of a single edge mounted radiating element. (Author Modified Abstract) GRA

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N73-24253 National Lending Library for Science and Technology, Boston Spa (England).
ON THE RELATIONSHIP BETWEEN POWER DISTRIBUTION AND TOLERANCE SENSITIVITY IN LINEAR TWO-TERMINAL NETWORKS
K. Dannowski 9 Apr. 1973 9 p refs Transl. into ENGLISH from Nachrichtentech. Elektronik (Berlin), v. 21, no. 12, Dec. 1971 p 422-424
(NLL-PO-2895-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The relationship between power distribution and tolerance sensitivity in linear, two-terminal networks is discussed. It is stated that the tolerance sensitivity of the emittance of a two-terminal network to component variations is proportional to the ratio of power of the component to the total power input of the two-terminal network. The proportionality also applies to the root sensitivity of the function of emittance. Circuit diagrams and mathematical models are included to support the theoretical considerations. Author

N73-24254 National Lending Library for Science and Technology, Boston Spa (England).
PROTECTION OF ELECTRONIC EQUIPMENT AGAINST ELECTROMAGNETIC DISTURBANCES
P. Charransol 9 Apr. 1973 23 p Transl. into ENGLISH from Commutation et Electronique (France), no. 38, Jul. 1972 p 83-91
(NLL-PO-2928-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

High-speed logic circuits present a problem in that the electronic equipment is sensitive to external electromagnetic disturbances. The detection and measurement of these disturbances and the manner in which adequate methods of protection can be provided are discussed. Author

N73-24255 National Lending Library for Science and Technology, Boston Spa (England).
FAULT TESTING AND LOCATION IN THE LOGIC UNIT OF A PERICLES MULTIRECORDER
R. LeCorvec and A. Lefer 8 Feb. 1973 25 p refs Transl. into ENGLISH from Commutation et Electronique (France), no. 38, Jul. 1972 p 32-41
(NLL-PO-2913-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The main aspects of fault diagnosis in logic circuits are described. The advantages and limitations of the various methods generally used are presented. The method adopted for locating faults in a Pericles electronic switching system multirecorder is reported. The function and effect of fault diagnosis on the structure of the assembly are analyzed. Author

N73-24256 National Lending Library for Science and Technology, Boston Spa (England).
AN IMPROVED NODE-POINT EQUATION METHOD FOR COMPUTING STEADY-STATE CONDITIONS OF ELECTRICAL SYSTEMS
K. F. Fazylov and T. K. Nasyrov 8 Feb. 1973 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk Uzb. SSR, Ser. Tekh. Nauk (USSR), no. 6, 1971 p 3-6
(NLL-PO-2922-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The system of nonlinear equations connecting the capacity and potential at node-points of an electrical network, which describe a steady-state are considered in four forms of initial information for node-points and unknowns. It is shown that conditions for the existence of real solutions and conditions for the convergence of the iterations solutions are the same. The latter can be used as an approximation in a preliminary assessment of the existence of a solution for node-point potential equations. F.O.S.

N73-24257 National Lending Library for Science and Technology, Boston Spa (England).
ION IMPLANTATION TECHNIQUE IN ELECTRONIC COMPONENT TECHNOLOGY
N. Urli 9 Apr. 1973 21 p refs Transl. into ENGLISH from Elektrotehnica (Belgrade), no. 1, 1971 p 5-15
(NLL-Trans-861-(9022.64)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The physical basis of ion implantation in semiconductors is presented, emphasized are the penetration depth of ions, implantation-produced damage of the crystal lattice as well as the electrical behavior of implanted ions. Applications of the new technique in the fabrication of semiconductor planar structures such as MOFSETS, integrated circuits, protective ring diodes and bipolar transistors, avalanche photodiodes, IMPATT diodes and varactors, are discussed. A brief review of results of ion implantation in binary semiconducting components is included. Author

N73-24258*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SERVOMECHANISM DESIGN TECHNIQUES AND APPLICATIONS AEROSPACE PROBLEMS
Vincent R. Lalli 1973 15 p refs Presented at Process Control Conf., Cleveland, 10 May 1973; sponsored by IEEE
(NASA-TM-X-68234; E-7463) Avail: NTIS HC $3.00 CSCL 09C

A cryogenic oxygen flow control servomechanism subsystem is described that is typical for an auxiliary power unit fuel system. Three possible types of feedback for this type of subsystem are: position with velocity feedback accomplished by gear train and synchro-transformer, position with velocity feedback accomplished by adding a rate generator and position feedback with compensating network. Servomechanisms employing any of these three types of subsystems can provide the oxygen flow control desired. The differences in performance relate primarily to steadiness of flow with the companion heat modulation. The damping ratio parameter can be used to achieve a reasonable response time. Author

N73-24259*# Stanford Univ., Calif. Guidance and Control Lab.
CONTROL THEORY FOR RANDOM SYSTEMS
Arthur E. Bryson, Jr. Sep. 1972 52 p refs Presented at 13th Intern. Congr. of Theoret. and Applied Mech., Moscow, 21-28 Aug. 1972
(Contract NAS2-5143)
(NASA-CR-132054; SUDAAR-447) Avail: NTIS HC $4.75 CSCL 09C

A survey is presented of the current knowledge available for designing and predicting the effectiveness of controllers for dynamic systems which can be modeled by ordinary differential equations. A short discussion of feedback control is followed by a description of deterministic controller design and the concept of system state. The need for more realistic disturbance models led to the use of stochastic process concepts, in particular the Gauss-Markov process. A compensator controlled system, with random forcing functions, random errors in the measurements, and random initial conditions, is treated as constituting a Gauss-Markov random process; hence the mean-square behavior of the controlled system is readily predicted. As an example, a compensator is designed for a helicopter to maintain it in hover in a gusty wind over a point on the ground. Author

N73-24260# Radio Corp. of America, Somerville, N.J. Advanced Communications Lab.
MOS THRESHOLD LOGIC 2 Final Technical Report, Dec. 1971 - Dec. 1972
Daniel Hampel, Kalman J. Prost, and Norman Scheinberg 15 Feb. 1973 85 p refs
(Contract N00019-72-C-0143)

(AD-758021) Avail: NTIS CSCL 09/1

The program represents the second phase in the Development of MOS threshold logic. Studies were made previously, indicating the limitations and applications of MOS threshold gates. Now, threshold gates were integrated for use in parallel array multipliers as well as for general logic synthesis. Two approaches were taken in CMOS technology; an analog and a functional design. The analog threshold gates consist of arrays of inverters and take dc power, by design. A 1 X 8 adder matrix was integrated for use in multipliers and, although the principle of the logic was demonstrated, a basic restriction was uncovered. The functional approach is based on a more conventional return to preserving all the advantages of CMOS and many of the advantages of threshold logic. A 4 X 4 adder array was integrated to demonstrate this approach and a multiplier breadboard was built to demonstrate the chips. Author (GRA)

N73-24261# Pennsylvania State Univ., University Park. Materials Research Lab.

IMPROVED NON-METALLIC MATERIAL FOR ELECTRONIC APPLICATION Technical Summary Report, 1 Jul. - 31 Dec. 1972

Rustum Roy Dec. 1972 28 p

(Contract DA-49-083-OSA-3140; ARPA Order 338)

(AD-758528) Avail: NTIS CSCL 09/3

Research was conducted on electro-optic materials. Single crystals of $Bi_4Ti_3O_{12}$ are grown in the correct platy habit and optimization of the growth condition is studied. The new ferroelastic materials isopropyl ammonium chloroplatinate and isopropyl ammonium chlorostannate have been grown as quite good quality crystals and many properties have been measured. The main effort has gone into preparation of coatings on crystals and glasses and their characterization. RF sputtering has been shown to be a tremendously versatile tool for the preparation of both crystalline and noncrystalline layers of many compositions. By controlling process parameters in the sputtering chamber, composition and valence state in the sputtered layers can be controlled. Glass surface coatings and glass surface strengthening have been prepared by CVD, microwave plasma, and ion exchange techniques. GRA

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N73-24262*# Curtiss-Wright Corp., Wood-Ridge, N.J. Power Systems Div.

DESIGN OF THERMAL PROTECTION SYSTEM FOR 8 FOOT HTST COMBUSTOR

S. Moskowitz [1973] 138 p refs

(Contract NAS1-11714)

(NASA-CR-112310; CW-WR-73-028) Avail: NTIS HC $9.00 CSCL 14B

The combustor in the 8-foot high temperature structures tunnel at the NASA-Langley Research Center has encountered cracking over a period of 50-250 tunnel tests within a limited range of the required operating envelope. A program was conducted which analyzed the failed combustor liner hardware and determined that the mechanism of failure was vibratory fatigue. A vibration damper system using wave springs located axially between the liner T-bar and the liner support was designed as an intermediate solution to extend the life of the current two-pass regenerative air-cooled liner. The effects of liner wall thickness, cooling air passage height, stiffener ring geometry, reflective coatings, and liner material selection were investigated for these designs. Preliminary layout design arrangements including the external water-cooling system requirements, weight estimates, installation requirements and preliminary estimates of manufacturing costs were prepared for the most promising configurations. A state-of-the-art review of thermal barrier coatings and an evaluation of reflective coatings for the gas-side surface of air-cooled liners are included. Author

N73-24263# National Aerospace Lab., Tokyo (Japan).

SYSTEM DESIGN OF FACILITIES FOR VTOL FLYING TEST BED AT NATIONAL AEROSPACE LABORATORY

Naoto Takizawa, Akiyoshi Shibuya, Toshio Gawa, Hirotoshi Fujieda, Tadao Kai, Yoshito Miyamoto, Yoshikazu Tanabe, Kazuyuki Takeuchi, and Koichi Ono 1972 53 p refs In JAPANESE; ENGLISH summary

(NAL-TR-306) Avail: NTIS HC $4.75 CSCL 14B

Systems design and a general description of facilities for studying hovering vertical takeoff, and vertical landing of VTOL aircraft are given. The facilities are divided into the following four main groups: ground support facilities, constrained test rigs, measuring apparatuses and ground establishment. Ground support facilities are provided for the operation and maintenance of the FTB, including those for rework, supply, inspection, adjustment and experiment. Constrained test rigs for the safety of over-all preflight experiments contain a force test rig, a height control test rig, and attitude control test rig and tie down test rigs. Measuring apparatus for the collection of precious data on the first VTOL flights in Japan are arranged in combination with special wiring, telemetering and others. Ground establishments for large scale field experiments consist of buildings, a constrained test field, and a free flight test field. Author

N73-24264*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DETERMINATION OF MOLECULAR CONTAMINATION PERFORMANCE FOR SPACE CHAMBER TESTS

John J. Scialdone Washington May 1973 22 p refs

(NASA-TN-D-7250; G-1088) Avail: NTIS HC $3.00 CSCL 14B

The limitations of chamber tests with regard to the molecular contamination of a spacecraft undergoing vacuum test were examined. The molecular flow conditions existing in the chamber and the parameters dictating the degree of contamination were analyzed. Equations and graphs were developed to show the fraction of molecules returning to the spacecraft out of those emitted and to show other chamber flow parameters as a function of chamber and spacecraft surface molecular pumping and geometric configuration. Type and location of instruments required to measure the outgassing, the degree of contamination, and the returning flows are also discussed. Author

N73-24265*# McDonnell Douglas Electronics Co., St. Charles, Mo.

SPACE SHUTTLE VISUAL SIMULATION SYSTEM DESIGN STUDY Final Analytical Report

30 Mar. 1973 151 p

(Contract NAS9-12651)

(NASA-CR-128940; MSC-06742) Avail: NTIS HC $9.75 CSCL 14B

The current and near-future state-of-the-art in visual simulation equipment technology is related to the requirements of the space shuttle visual system. Image source, image sensing, and displays are analyzed on a subsystem basis, and the principal conclusions are used in the formulation of a recommended baseline visual system. Perceptibility and visibility are also analyzed. Author

N73-24266# National Aviation Facilities Experimental Center, Atlantic City, N.J.

INVESTIGATION OF SITE COVERAGE AND ASSOCIATED PROBLEMS AT THE O'HARE AIRPORT, CHICAGO, ILLINOIS, ENROUTE RADAR BEACON TEST SITE Interim Report, Sep. 1971 - Sep. 1972

George F. Spingler Apr. 1973 62 p

(FAA-RD-73-49; FAA-RD-73-38) Avail: NTIS HC $5.25

A temporary beacon test site was installed adjacent to the Chicago, Illinois, O'Hare Airport and operational tests were conducted to determine its suitability for possible use as a future enroute radar beacon site. Photographic data were collected using targets-of-opportunity flying within the coverage area of the test site. The data were analyzed to determine the extent of the radar beacon coverage and further scrutinized to uncover any anomolies which might derogate the operation of an enroute

radar beacon site installed at the test location. Flight tests confirmed the originally suspected problem areas and provided additional justification for linking the anomolies to the vertical radiation pattern of the standard radar beacon directional antenna. Author

N73-24267*# Kanner (Leo) Associates, Redwood City, Calif.
THE EFFECTS OF SUBGRAVITY AND SIMULATION METHODS IN THE LABORATORY AND IN FLIGHT
G. Meineri Washington NASA Jun. 1973 24 p refs Transl. into ENGLISH from Riv. Med. Aeron. Spaziale (Rome), v. 26, 1963 p 80-98
(Contract NASw-2481)
(NASA-TT-F-14934) Avail: NTIS HC $3.25 CSCL 14B

The problem of subgravity is discussed with an account of the most creditable experimental solutions devised in the past 10 years of space flight. The chief methods and apparatus used to simulate subgravity conditions are described and a distinction was made between ground methods and the more cumbersome methods of parabolic flight, and suborbital and orbital launching of missiles through which subgravity conditions can be attained. A description is given of the subgravity tower designed and installed for obtaining real, though short term, subgravity conditions, preceded and followed by periods of acceleration. The tower was used to solve space flight problems, particularly the transition between the active and passive stages. Author

N73-24268*# Scientific Translation Service, Santa Barbara, Calif.
THE FIRST AERODYNAMIC THREE-PHASE ELECTRIC POWER PLANT IN BALAKLAWA
W. R. Sectorov Washington NASA Jun. 1973 13 p Transl. into ENGLISH from L'Elettrotecnica (Italy), v. 21, no. 23-24, Aug. 1934 p 538-542
(Contract NASw-2483)
(NASA-TT-F-14933) Avail: NTIS HC $3.00 CSCL 10B

The assembly and functional characteristics of an experimental 100 kW power plant built in Crimea are described. The operating data obtained during the first two years of operation are reported. Author

N73-24269# National Physical Lab., Teddington (England).
MEASUREMENT OF THE TIME-AVERAGE FORCES AND PITCHING MOMENTS ON A PROPOSED HELICOPTER LANDING PLATFORM FOR THE WOLF ROCK LIGHTHOUSE
C. F. Cowdrey and D. W. Bryer Mar. 1973 18 p refs
(Mar-Sci-R-106) Copyright. Avail: NTIS HC $3.00

Wind tunnel tests were conducted to determine the time-averaged aerodynamic forces and overturning moments on a model of a helicopter landing platform to be installed on the top of a lighthouse. The construction of the supporting framework and its attachment to the lighthouse are described. Visualization of the flow over the model did not reveal any unusual features which would have an adverse effect on the operation of helicopters from the full scale landing pad. A safe configuration of the landing pad is described. Author

N73-24270*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR THE MARINER MARS 1971 MISSION. VOLUME 3: ORBIT INSERTION THROUGH END OF PRIMARY MISSION
P. W. Barnum, N. A. Renzetti, G. P. Textor, and L. B. Kelly 15 May 1973 154 p
(Contract NAS7-100)
(NASA-CR-132955; JPL-TM-33-523-Vol-3) Avail: NTIS HC $9.75 CSCL 17I

The Tracking and Data System (TDS) Support for the Mariner Mars 1971 Mission final report contains the deep space tracking and data acquisition activities in support of orbital operations. During this period a major NASA objective was accomplished: completion of the 180th revolution and 90th day of data gathering with the spacecraft about the planet Mars. Included are presentations of the TDS flight support pass chronology data for each of the Deep Space Stations used, and performance evaluation for the Deep Space Network Telemetry, Tracking, Command, and Monitor Systems. With the loss of Mariner 8 at launch, Mariner 9 assumed the mission plan of Mariner 8, which included the TV mapping cycles and a 12-hr orbital period. The mission plan was modified as a result of a severe dust storm on the surface of Mars, which delayed the start of the TV mapping cycles. Thus, the end of primary mission date was extended to complete the TV mapping cycles. Author

N73-24271*# Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.
DEVELOPMENT OF A SUPERCONDUCTING ELECTROMAGNETIC SUSPENSION AND BALANCE SYSTEM FOR DYNAMIC STABILITY STUDIES Final Technical Report
Ricardo N. Zapata Feb. 1973 76 p refs
(Grant NGR-47-005-029)
(NASA-CR-132255; ESS-4009-101-73U) Avail: NTIS HC $6.00 CSCL 14B

A prototype facility comprising a superconducting magnetic suspension and balance and a supersonic wind tunnel was developed with the objectives of (1) establishing the feasibility of applying the 3-component magnetic balance concept to dynamic stability studies, and (2) investigating design concepts and parameters that are critical for extrapolation to large scale systems. Many important design and operational aspects are dictated by the cryogenic nature of this advanced technology facility. Results of initial tests demonstrate that superconductors can be utilized safely and efficiently for wind tunnel magnetic suspensions. Controlled one-dimensional support of a spherical model was achieved. For individual titles, see N73-24272 through N73-24277.

N73-24272* Virginia Univ., Charlottesville. Dept. of Aerospace Engineering and Engineering Physics.
THE UNIVERSITY OF VIRGINIA SUPERCONDUCTING MAGNETIC SUSPENSION AND BALANCE FACILITY
Ricardo N. Zapata *In its* Develop. of a Superconducting Electromagnetic Suspension and Balance System for Dyn. Stability Studies Feb. 1973 22 p refs (For availability see N73-24271 15-11)
(Grants NGR-47-005-029; NGR-47-005-110; NGR-47-005-112 CSCL 14B

A prototype facility comprising a superconducting magnetic suspension and balance and a supersonic wind tunnel was developed with the objectives of (1) establishing the feasibility of applying the 3-component magnetic balance concept to dynamic stability studies, and (2) investigating design concepts and parameters that are critical for extrapolation to large-scale systems. Many important design and operational aspects as well as safety considerations are dictated by the cryogenic nature of this advanced-technology facility. Results of initial tests demonstrate that super-conductors can be utilized safely and efficiently for wind tunnel magnetic suspensions. At the present stage of development of this facility, controlled one-dimensional support of a spherical model was achieved. Author

N73-24273* Virginia Univ., Charlottesville. Dept. of Aerospace Engineering and Engineering Physics.
THE USE OF SUPERCONDUCTIVITY IN MAGNETIC BALANCE DESIGN **c26**
F. E. Moss *In its* Develop. of a Superconducting Electromagnetic Suspension and Balance System for Dyn. Stability Studies Feb. 1973 15 p refs (For availability see N73-24271 15-11)
CSCL 14B

The magnetic field and field gradient requirements for magnetic suspension in a Mach 3, 6-in. diameter wind tunnel are stated, along with the power requirements for gradient coil pairs wound of copper operating at room temperature and aluminum cooled to 20 K. The power dissipated is large enough that the use of superconductivity in the coil design becomes an attractive alternative. The problems of stability and ac losses are outlined along with the properties of stabilized superconductors. A brief review of a simplified version of the critical state model of C. P. Bean is presented, and the problems involved in calculations of the ac losses in superconducting coils are outlined. A summary of ac loss data taken on pancake coils wound of commercially available Nb3Sn partially stabilized tape is presented and shown as leading to the U.Va. gradient coil design. The actual coil performance is compared with predictions based on the BNL results. Finally, some remarks are presented concerning scaling of the ac losses to larger magnetic suspension systems

as well as prospects for improved performance using newer multifilament superconductors. Author

N73-24274* Virginia Univ., Charlottesville. Dept. of Aerospace Engineering and Engineering Physics.
DATA ACQUISITION AND REDUCTION FOR THE UNIVERSITY OF VIRGINIA SUPERCONDUCTING MAGNETIC SUSPENSION AND BALANCE FACILITY
I. D. Jacobson, J. L. Junkins, and J. R. Jancaitis *In its* Develop. of a Superconducting Electromagnetic Suspension and Balance System for Dyn. Stability Studies Feb. 1973 12 p refs (For availability see N73-24271 15-11)
(Grants NGR-49-005-029; NGR-47-005-149; NGR-47-005-112)
CSCL 14B

The problems associated with data acquisition and reduction in the U.Va. superconducting magnetic suspension and balance facility are similar to those in free-flight ranges (or tunnels). The model undergoes a Quasi-six-degree of freedom motion which must be monitored both in position and angular orientation problem is made more difficult because geometric constraints prevent direct visual access to the model in the Mach 3 wind tunnel. The methods, accuracies and problems associated with the acquisition of data are discussed. Author

N73-24275* Virginia Univ., Charlottesville. Dept. of Aerospace Engineering and Engineering Physics.
THE USE OF IRON AND EXTENDED APPLICATIONS OF THE UNIVERSITY OF VIRGINIA COLD BALANCE WIND TUNNEL SYSTEM
H. M. Parker and J. R. Jancaitis *In its* Develop. of a Superconducting Electromagnetic Suspension and Balance System for Dyn. Stability Studies Feb. 1973 10 p (For availability see N73-24271 15-11)
(Grants NGR-47-005-029; NGR-47-005-112)
CSCL 14B

The prototype design of the University of Virginia Cold Magnetic Balance Wind Tunnel System, primarily for assured performance, is based on the use of ferrites for the magnetic support element and for the case of spinning missile configurations in supersonic flow. The extension of applicability to noncontinuously spinning airplane configurations and to subsonic flow regimes would be highly desirable. The problems involved in these extensions are discussed. The possible use of iron for the magnetic support element, or some material reasonable equivalent, is found to be crucial. The existing theoretical evidence that iron may be used without penalty is summarized. Author

N73-24276* Virginia Univ., Charlottesville. Electronic Instrumentation Group.
ELECTROMAGNETIC POSITION SENSOR FOR A MAGNETICALLY SUPPORTED MODEL IN A WIND TUNNEL
William R. Towler *In its* Develop. of a Superconducting Electromagnetic Suspension and Balance System for Dyn. Stability Studies Feb. 1973 4 p (For availability see N73-24271 15-11)
CSCL 14B

An investigation was undertaken to determine the feasibility of using superconducting force-producing coils for positioning a model in a wind tunnel. The cryostat containing the forcing coils surrounded the test section of the tunnel, thus favoring an electromagnetic position sensor. Another reason favoring this choice was the fact that the performance of an electromagnetic sensor is essentially unaffected by the shape of the model. Author

N73-24277* Virginia Univ., Charlottesville.
SAFETY ASPECTS OF SUPERCONDUCTING MAGNETIC SUSPENSION SYSTEMS
Ricardo N. Zapata *In its* Develop. of a Superconducting Electromagnetic Suspension and Balance System for Dyn. Stability Studies Feb. 1973 9 p refs (For availability see N73-24271 15-11)
CSCL 14B

Safety procedures and devices used to insure superconducting magnetic suspension system reliability are outlined. Power supplies and system failure are included. E.H.W.

N73-24278*# Aerojet Nuclear Systems Co., Azusa, Calif.
CHILLDOWN STUDY OF THE SINGLE STAGE INDUCER TEST RIG
L. A. Kimura 2 Jun. 1972 29 p Sponsored by NASA (Proj. 110)
(NASA-CR-132212; N8110R:72-033) Avail: NTIS HC $3.50 CSCL 14B

Of the six chilldown tests, data from only one could be used for evaluation. During the rest of the chilldown tests, there was leakage hydrogen flow into the pump cavity prior to the initiation of the chilldown test. In all of the tests the hydrogen condition into the pump was probably 100% vapor. The data from this one test, therefore, can be used to compare only the single phase fluid correlation in the analytical pump chilldown model. In general, the actual pump chilled down much faster than predicted by the analytical pump model. There were insufficient data from the test to measure the pump flow rate and pump inlet fluid condition; therefore, these parameters were extrapolated based on related data which were available. However, even with the highest probable flow rate, the pump chilled faster than predicted. Author

N73-24279*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE MINITRACK TRACKING FUNCTION DESCRIPTION, VOLUME 1
Thomas S. Englar, Stephen A. Mango, Charles A. Roettcher, and David L. Watters Mar. 1973 186 p refs Prepared by Control Systems Res., Inc.
(Contract NAS5-10694)
(NASA-TM-X-66213; X-591-73-68-Vol-1) Avail: NTIS HC $11.50 CSCL 14B

The treatment of tracking data by the Minitrack system is described from the transmission of the nominal 136-MHz radio beacon energy from a satellite and the reception of this signal by the interferometer network through the ultimate derivation of the direction cosines (the angular coordinates of the vector from the tracking station to the spacecraft) as a function of time. Descriptions of some of the lesser-known functions operating on the system, such as the computer preprocessing program, are included. A large part of the report is devoted to the preprocessor, which provides for the data compression, smoothing, calibration correction, and ambiguity resolution of the raw interferometer phase tracking measurements teletyped from each of the worldwide Minitrack tracking stations to the central computer facility at Goddard Space Flight Center. An extensive bibliography of Minitrack hardware and theory is presented. Author

N73-24280# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LABORATORY SIMULATION OF IONOSPHERIC PLASMA
Marc Charpenel and Daniel Pigache Nov. 1972 22 p refs In FRENCH; ENGLISH summary Sponsored in part by CNES
(ONERA-NT-202) Avail: NTIS HC $3.25

An exact simulation of satellite motion in the ionospheric plasma was obtained in a large vacuum chamber by means of a synthesized collisionless plasma jet produced by a low energy and high current density ion sources. The plasma density, beam velocity, and electron temperature can be varied between 10,000 and 1,000,000/cu cm, 7 and 30 km/sec, 500 and 2000 K, respectively. An approximate solution of a sounding rocket motion in the D and E layers was obtained with the same plasma source by increasing the pressure in the vacuum chamber. The ion beam velocity was then reduced to zero but the variation ranges of plasma density and electron temperature remained unchanged. ESRO

N73-24281# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
TWO-DIMENSIONAL AEROFOIL TEST FACILITY IN THE S3 BLOW-DOWN WIND-TUNNEL OF MODANE-AVRIEUX [DISPOSITIF D'ESSAIS DE PROFILS EN COURANT PLAN DANS LA SOUFFLERIE S3 DE MODANE-AVRIEUX]
Maurice Bazin Oct. 1972 17 p refs In FRENCH; ENGLISH summary
(ONERA-NT-203) Avail: NTIS HC $3.00

A device for two dimensional airfoil profile testing in the

transonic test section of the blowdown wind tunnel S3 was designed and built. Airfoils up to 0.3 m chord length can be studied by pressure measurements up to 0.95 Mach, with stagnation pressure from 1.2 to 4.0 bars. The Reynolds number can be varied up to 15,000,000 at Mach 0.95. The main features of the device are outlined and its various components described, including a 0.78 x 0.56 m test section with horizontal perforated walls, rotating supports for angle of attack variations from -35 to +215 deg, mobile rake for wake pressure survey, models with wall pressure taps. The method and means for data acquisition are given along with the aerodynamic characteristics of the test device. The visualization methods are described, and improvements are suggested. ESRO

N73-24282# European Southern Observatory, Hamburg (West Germany).
[RESEARCH ACTIVITIES OF ESO] Annual Report, 1971
1972 74 p refs
Avail: NTIS HC $5.75

The work carried out at the European Southern Observatory during 1971 including research projects and maintenance of equipment and buildings is reported. ESRO

N73-24283# Nielsen Engineering and Research, Inc., Mountain View, Calif.
A STUDY OF NARROW BAND NOISE GENERATION BY FLOW OVER VENTILATED WALLS IN TRANSONIC WIND TUNNELS
James P. Woolley and Krishnamurty Karamcheti (Stanford Univ.) Feb. 1973 89 p refs
(Contract F44620-72-C-0010; AF Proj. 9781)
(AD-758254; NEAR-TR-50; AFOSR-73-0503TR) Avail: NTIS CSCL 14/2

The report is concerned with the problem of environmental noise in transonic wind tunnels with ventilated, or perforated, walls. A brief critical review of past experimental investigations of such sounds is given. It is indicated that the instability of the separated shear layer over the cavities in a perforated wall should be the main agency for sound generation. A stability analysis of a nonparallel shear flow is undertaken. Relations such as the Strouhal numbers and minimum breadths, are given in terms of wind-tunnel aerodynamic parameters. (Author Modified Abstract) GRA

N73-24284# Naval Training Equipment Center, Orlando, Fla. Computer Lab.
DIGITAL RADAR LANDMASS SIMULATION Interim Report, 1969 - 1972
Craig E. Brown and Alexander J. Grant Feb. 1973 124 p
(AD-758363; NAVTRAEQUIPC-IH-196) Avail: NTIS CSCL 05/9

The purpose of the in-house Radar Landmass Simulation (RLMS) project is to develop a research tool for study in the area of digital radar training devices. The tool should help one to determine an optimum specification for procured hardware and to define the training requirements, offer a means of evaluating proposed hardware schemes through simulation of the proposed schemes, and be capable of producing a simulated radar scope display in simulated real-time. Finally, the research tool should be easily changeable to facilitate experimentation. The report contains a general description of the hardware and software which has been developed, with emphasis on the results obtained. The appendices contain detailed schematics for the hardware, flowcharts and listings for the software. GRA

N73-24285# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
CONDITION SURVEY, HUNTER AIRFIELD, SAVANNAH, GEORGIA
R. D. Jackson and P. J. Vedros Mar. 1972 36 p
(AD-757387; AEWES-Misc-Paper-S-72-8) Avail: NTIS CSCL 01/5

The purpose of this report is to present the results of an inspection performed at Hunter Army Airfield (HAAF) in March 1971. The inspection was limited to visual observations, and no tests were conducted on any of the pavement facilities. A layout of the airfield is given. (Author Modified Abstract) GRA

N73-24286# Army Foreign Science and Technology Center, Charlottesville, Va.
REPAIR OF UNPAVED RUNWAY
V. Ermolchuk 22 Dec. 1972 5 p Transl. into ENGLISH from Aviatsiya i Kosmonavtika (Moscow), no. 4, 1967 p 60-61
(AD-756806; FSTC-HT-23-2043-72) Avail: NTIS CSCL 01/5

The landing field is destroyed as one uses unpaved airfields. The runway surface should be packed down and the tracks closed up. Experience has shown that closing deep tracks with the 2-bladed plow sharply improves the productivity and quality of work. Expenditures of time and resources on repairing damaged portions of the landing field are reduced two to three times when employing the plow. It is especially effective on airfields where intensive flying is carried out. The tractor-mounted, 2-bladed plow is easy to use, simple in design and can be produced by repair workshops. GRA

N73-24032 Ministry of Aviation, London (England).
PERFORMANCE OF THE 36 BY 35 INCHES SLOTTED TRANSONIC WORKING SECTION OF THE RAE BEDFORD 3-FOOT WIND TUNNEL
E. P. Sutton, M. T. Caiger, and A. Stanbrook *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1509-1531 refs
Previously issued as RAE-Aero-2622; ARC-21908 (For availability see N73-24011 15-01)
(ARC-R/M-3228; RAE-Aero-2622; ARC-21908)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N73-24287 National Lending Library for Science and Technology, Boston Spa (England).
THE PHYSICAL PROPERTIES OF HYDRAULIC FLUIDS AND THEIR EFFECT ON OPERATING BEHAVIOR
Heinz Nehls 8 Feb. 1973 12 p refs Transl. into ENGLISH from Oelhydraulik u Pneumatik (West Germany), v. 14, no. 8, 1970 p 369-372 In ENGLISH and GERMAN
(NLL-NEL-TT-2427-(6075.461)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Hydraulic fluid density and its effects on the effective output of the pump, the frictional losses, and the maximum suction head are investigated. E.H.W.

N73-24288 National Lending Library for Science and Technology, Boston Spa (England).
ELIMINATION OF THE INFLUENCE OF INSTALLATION DISTURBANCE ON FLOW MEASUREMENTS WITH ORIFICE PLATES
G. Ehrhardt 5 Feb. 1973 13 p refs Transl. into ENGLISH from Brennstoff-Waerme-Kraft (Duesseldorf), v. 24, no. 12, 1972 p 449-452 In GERMAN and ENGLISH
(NLL-NEL-TT-2439-(6075.461)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effects of undisturbed pipe lengths upstream of the throttling elements for flow-rate measurements are discussed. Tests were conducted to show that while retaining prescribed throttling elements and flow rates, the undisturbed pipe lengths can be shortened without adverse effects. This is attained by introducing between the installation disturbance and the throttling elements a definitive disturbance, called a spoiler plate. Proper installation and dimensions of the spoiler plate can result in overriding the unknown influence of the installation disturbance. Author

N73-24289 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF UNDISSOLVED AIR ON THE COMPRESSIBILITY OF THE TRANSMITTING MEDIUM OF HYDROSTATIC CIRCUITS
D. G. Feldmann 5 Feb. 1973 13 p refs Transl. into ENGLISH from Oelhydraulik Pneumatik (West Ger.), v. 14, no. 8, 1970

p 343-346 In ENGLISH and GERMAN
(NLL-NEL-TT-2426-(6075.461)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effect of undissolved air on the compressibility of the transmitting medium in hydraulic circuits is discussed. Essential factors which affect the performance of hydraulic circuits are described. Mathematical models to show the compressibility of hydraulic fluids and the compressibility of an air-oil mixture are developed. It is concluded that a level of three percent air in the hydraulic fluid requires doubling the compressibility to maintain proper operation of the hydraulic equipment. Author

N73-24290 National Lending Library for Science and Technology, Boston Spa (England).
APPROXIMATE METHODS OF CALCULATING THE DIRECT PROBLEM IN OPTIMIZING THE HEATING OF METAL, REPORT 1
V. Yu. Kaganov and V. M. Orkin [1972] 12 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), v. 11, 1972 p 164-168
(NLL-M-21618-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The Kantorovich method was used for the numerical calculation of the direct problem for the heating of an unidimensional plate under nonlinear boundary conditions. The relationship of the thermal and physical constants to temperature was determined. A system of integral differential equations obtained by using the Kantorovich method is solved by the differences method using a predictor-corrector system. Author

N73-24291 National Lending Library for Science and Technology, Boston Spa (England).
LAMINAR BREAKUP LENGTH AND DROPLET SIZE FOR A LIQUID JET IN AIR
T. Takahashi and Y. Kitamura Apr. 1973 16 p refs Transl. into ENGLISH from Kagaku Kogaku (Tokyo), v. 36, no. 5, 1972 p 77-83 (527-533)
(NLL-RTS-8049) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.50; 5 NLL photocopy coupons

Experiments of laminar breakup strength and droplet size for jets of liquids of different viscosity and surface tension ejected vertically downward into the atmosphere are discussed. The test equipment used and the techniques for conducting the experiments are described. Data are included to show: (1) the breakup length, (2) the breakup pattern, (3) the size of droplets formed from the liquid jet, and (4) the initial amplitude of surface disturbance. Author

N73-24292 Rensselaer Polytechnic Inst., Troy, N.Y.
A THEORETICAL STUDY OF FLUID DYNAMIC ENERGY SEPARATION Ph.D. Thesis
Philip Alan Graham 1972 380 p
Avail: Univ. Microfilms Order No. 72-30212

Three distinct classes of fluid mechanics techniques for energy separation are presented. One is steady flow, employed by the Ranque-Hilsch vortex tube (RHT). Another is nonsteady flow, utilized in the dynamic pressure exchanger divider (DPE). The third is cryptosteady flow, wherein the flow is nonsteady relative to the reference frame in which it is used but is steady as viewed in a unique moving reference frame; the Foa energy separator (FES) uses this type of flow. A theoretical study of energy separation is presented whose focus is the FES but which also gives contextual attention to the RHT and DPE. Brief comparison of the three devices indicates that the FES substantially outperforms the RHT, being competitive with the DPE at low pressure ratios where the latter achieves best performance, but without exhibiting similar deterioration in efficiency with increasing pressure ratio. Dissert. Abstr.

N73-24293 Rochester Univ., N.Y.
ON EFFECT OF SMALL AMPLITUDE WALL WAVINESS UPON THE STABILITY OF THE LAMINAR BOUNDARY LAYER WITH RESPECT TO TWO-DIMENSIONAL DISTURBANCES Ph.D. Thesis
Santu Thakurdas Gangwani 1972 117 p
Avail: Univ. Microfilms Order No. 72-28751

The wall waviness introduces standing disturbances by its presence. These disturbances are of finite amplitude but still small and therefore governed by the Orr-Sommerfeld equation. Since the disturbances are of finite amplitude, the effect of Reynolds stresses are included. The interaction of the higher harmonics is assumed to be negligible. A laminar boundary layer flow past a wall of small waviness is considered and the mean flow field is taken to be the x-component velocity of the Blasius boundary layer solution. The Reynolds stresses due to the disturbances induced by the wall waviness are obtained. The modification of the Blasius velocity profile, due to the effect of Reynolds stresses, is determined. This altered velocity profile is used to obtain a better approximation to the Reynolds stresses and in turn, the mean flow. The procedure is repeated recursively until there is no appreciable change in the modified velocity profile. Dissert. Abstr.

N73-24294 Polytechnic Inst. of Brooklyn, N.Y.
COMPRESSIBLE CORNER FLOW Ph.D. Thesis
Bernard Chaim Weinberg 1972 119 p
Avail: Univ. Microfilms Order No. 72-28302

The viscous compressible flow in the vicinity of a right angle corner, formed by the intersection of two perpendicular flat plates and aligned with the free stream, is investigated. In the absence of viscous-inviscid interactions and imbedded shock waves, a theory is developed that is valid throughout the subsonic and supersonic Mach number range. Within this limitation and the additional assumptions of unit Prandtl number and a linear viscosity temperature law, a consistent set of governing equations and boundary conditions are derived. The method of matched asymptotic expansions is applied in order to distinguish the relevant regions in the flow field. In the corner region the Crocco integral is shown to apply, even for a three-dimensional flow field. Results of calculations are presented for representative compressible flow conditions. Dissert. Abstr.

N73-24295 Michigan Univ., Ann Arbor.
BASE PRESSURE IN SUPERSONIC LAMINAR FLOW Ph.D. Thesis
Gary Richard Hough 1972 100 p
Avail: Univ. Microfilms Order No. 72-29093

The problem of determining the base pressure in the case of supersonic flow over a slender wedge or backward-facing step is studied. The flow is assumed to remain laminar throughout the region of interest. An asymptotic model, valid in the limit as the Reynolds number approaches infinity, is developed to describe the neap wake. A numerical solution of the sublayer equations is undertaken, based upon a Pohlhausen-type approach. A relatively simple model which approximates the correct shear behavior near the base, as well as satisfying the boundary condition at the base itself, is proposed. The resulting equations are integrated numerically in the downstream direction. In spite of some arbitrariness in the method, the downstream pressure distribution is in overall agreement with experimental results. Dissert. Abstr.

N73-24296 Virginia Polytechnic Inst. and State Univ., Blacksburg.
DECOMPOSITION OF A LIQUID JET INJECTED NORMAL TO A SUPERSONIC AIRSTREAM Ph.D. Thesis
Edward Arthur Kush, Jr. 1972 258 p
Avail: Univ. Microfilms Order No. 72-29576

A study of the breakup of a liquid jet injected normal to a supersonic airstream was carried out. Included were the effect of important parameters: (1) liquid properties, (2)jet flow rate, (3) dynamic pressure ratio of jet to free stream, (4) Mach number (2.4 to 4.0), (5) boundary layer thickness upstream of the jet, (6) orifice size and shape, and (7) level of jet back pressure relative to liquid vapor pressure. It was found that high-frequency, axially-propagating waves are intrinsic to the jet behavior, and moreover, these waves supply the principal decomposition mechanism, since in their instability they grow along the curved jet to a point where a large clump of fluid detaches from the cohesive jet at a wave-trough and is accelerated downstream, where it undergoes further decomposition. Dissert. Abstr.

N73-24297 Maryland Univ., College Park.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF HYPERSONIC VISCOUS SHOCK LAYER ON A BLUNT-NOSED BODY Ph.D. Thesis
Dandamudi V. Krishnarao, 1972 71 p

Avail: Univ. Microfilms Order No. 72-29625

The hypersonic flow of a perfect gas past an axisymmetric blunt-nosed body is considered in the context of the viscous shock layer. The Navier-Stokes equations are accepted as the governing equations of the flow field. The Reynolds number is high for flow conditions of interest so that Rankine-Hugoniot relations are applicable at the shock wave. All the variables are normalized by appropriate parameters such that they are bounded in the shock layer. The Navier-Stokes equations are transformed into a modified VonMises coordinate system and a systematic order of magnitude analysis is carried out to derive a set of simplified equations. These equations, which are of a Hyperbolic-Parabolic nature, include all the second order terms and are valid in the entire shock layer. The experimental investigation was conducted in a helium tunnel at Mach number 17. The thin wall transient technique was used to measure the heat transfer coefficient on a paraboloid. The measured value of the Stanton number agrees well with the numerical result in the stagnation region. But far downstream the agreement is not satisfactory although the observed shock shape agrees well with the computed shock shape. The discrepancy is partly due to the numerical problems associated with the large value of specific heat ratio and the body shape. Dissert. Abstr.

N73-24298 Stanford Univ., Calif.
THE MOTION OF A SPHERE IN A COMPRESSIBLE LOW-REYNOLDS-NUMBER FLOW Ph.D. Thesis
Aleck Li-mie Lee 1972 96 p
Avail: Univ. Microfilms Order No. 72-30657

Mach number effects on the motion of a sphere in an unbounded fluid is examined. The motion is governed by the compressible Navier-Stokes equations. Solutions with slip boundary conditions and with non-slip boundary conditions are obtained by the method of matched asymptotic expansion. The ranges of parameters and the properties of the corresponding equations are discussed. The effect of Mach number shows in the variation of density and the velocity slip on the surface of the body. The impressed temperature difference is assumed to be zero. The variations of transport coefficients are small and neglected. The ratio of M2 to Re2, alpha, is introduced, which is treated as a finite parameter in the analysis. The conditions of flow can be specified by assigning an appropriate value to alpha. Finally, a patched formula is proposed, which takes both slip boundary conditions and higher order solutions into consideration. Dissert. Abstr.

N73-24299 Princeton Univ., N.J.
ACOUSTIC DAMPING DEVICES: THEORIES AND EXPERIMENTS Ph.D. Thesis
Pier Kueiyung Tang 1972 282 p
Avail: Univ. Microfilms Order No. 72-29834

Based on the jet-flow model which is manifested in the nonlinearity of the orifice flow upon the passage of a high intensity wave, the theories of a quarter-wave tube, a Helmholtz resonator, and a long damping device have been developed under various chamber flow conditions. The performance of these dampers can be characterized by a quantity known as the real part of the admittance coefficient. It is found that the conventional Helmholtz resonator has the least peak performance but response is quite flat over a certain frequency range. On the other hand, a quarter-wave tube offers the best peak in energy absorption with rather poor off-resonance behavior. Once the orifice length goes beyond the quarter-wave tube configuration, the performance of the so-called long damping device is even less attractive away from resonance. The effect of chamber flow enhances the damping in near-resonance region, but energy feedback can take place off-resonance due to the velocity oscillation.
Dissert. Abstr.

N73-24300 Princeton Univ., N.J.
FORMATION AND DETECTION OF MOLECULAR CLUSTERS IN A SUPERSONIC FREE JET Ph.D. Thesis
Gregory Neale Hughes 1972 234 p
Avail: Univ. Microfilms Order No. 72-29792

A theoretical model has been developed for condensation in a free jet expansion. This model predicts cluster size distributions for various materials and experimental conditions. The model suggests one range of experimental variables where nucleation is uncoupled from growth and another region where the final size distribution is very sensitive to the nucleation kinetics. In separate experiments, sulfur and silver iodide were vaporized, combined with a preheated inert carrier gas, and expanded through a small orifice into a vacuum. The clusters formed in this free jet were mass analyzed using standard mass spectroscopy, electron microscopy, and a new technique introduced here as Neutral Time-of-Flight Mass Spectroscopy (NTOFMS). This new method was developed to avoid the problem of cluster fragmentation in an ion source and is based on the theory of Miller and Andres for non-ideal free jet expansions. Dissert. Abstr.

N73-24301 Polytechnic Inst. of Brooklyn, N.Y.
THE RESPONSE OF A DIFFUSION-CONTROLLED ELECTRODE TO PULSED LAMINAR FLOW Ph.D. Thesis
John Jay McFeely 1972 267 p
Avail: Univ. Microfilms Order No. 72-28261

The wall mass transfer coefficient for the pulsed laminar flow in a pipe of a Newtonian fluid containing a dissolved electrolyte was experimentally observed using a diffusion controlled electrode technique. Nickel electrodes were imbedded in the wall of a one-half inch PVC pipe contained within a flow loop, and an aqueous electrolyte was passed through the system in such a mannar as to possess both steady laminar and simple harmonic velocity components. By observing the variation in the rate of the electrolytic reaction occurring at the electrode, the effect of the unsteady velocity field on this diffusion controlled reaction was determined. A comparison of the data with the existing mathematical solutions is presented as well as a high frequency equation which fits the data with an average deviation of 5.38%. Dissert. Abstr.

N73-24302 University of Southern Calif., Los Angeles.
THE THREE-DIMENSIONAL STRUCTURE OF TRANSONIC FLOWS INVOLVING LIFT Ph.D. Thesis
Mohammed Mahmound Hafez 1972 90 p
Avail: Univ. Microfilms Order No. 72-27661

The problem of steady transonic flows over lifting configurations having a nonvanishing finite leading-edge sweep angle is formulated on the basis of an asymptotic theory. Numerical methods are developed to solve the reduced lifting problems in the thickness-dominated regime. The theory shows that the flow field consists of an inner region similar to that in the classical slender-body theory and an outer nonlinear region governed by the familiar transonic small disturbance equation in three dimensions. Depending on the relative contribution of the lateral forces, the scales and the symmetry property of the outer region vary and three regimes can be identified: (1) the thickness-dominated regime, (2) the intermediate regime, and (3) the lift-dominated regime. Dissert. Abstr.

N73-24303 Stanford Univ., Calif.
THE TURBULENT BOUNDARY LAYER ON A POROUS PLATE: AN EXPERIMENTAL STUDY OF THE FLUID MECHANICS FOR ADVERSE FREE-STREAM PRESSURE GRADIENTS Ph.D. Thesis
Peter Sten Andersen 1972 194 p
Avail: Univ. Microfilms Order No. 72-30584

An experimental investigation of transpired turbulent boundary layers in zero and adverse pressure gradients has been carried out. Profiles of: (1) the mean velocity, (2) the three intensities of the turbulent fluctuations, and (3) the Reynolds stress were obtained by hot-wire anemometry. The friction coefficients were measured by using an integrated form of the boundary layer equation to extrapolate the measured shear stress profiles to the wall. Dissert. Abstr.

N73-24304+ Ernst-Mach-Inst., Freiburg (West Germany).
ANALYTIC DESCRIPTION OF REFLECTED SHOCK WAVE EXPANSION AT THE MACH REFLECTION ON WEDGES [EINE ANALYTISCHE BESCHREIBUNG DER AUSBREITUNG DES REFLEKTIERTEN STOSSES BEI DER MACH'S SCHEN REFLEXION AN KEILEN]
H. G. Prasse Oct. 1972 41 p refs In GERMAN; ENGLISH summary
(Rept-4/72) Avail: NTIS HC $4.25

Experimental investigations were carried out to analytically describe the curved part of a shock wave reflected on a wedge.

as data from the literature do not predict the curved reflected shock in Mach and regular reflection. The analytical description is obtained from the diffraction by wedges, from which the shock Mach number and the flow directly underneath the reflected wave can be calculated. Investigations with flattened and shifted wedges show the influence of the wedge apex on the shape of the reflected shock. ESRO

N73-24305+ Ernst-Mach-Inst., Freiburg (West Germany).
DIFFUSED SHOCK WAVE REFLECTION [DIFFUSE REFLEXION EINER STOSSWELLE]
F. Schultz-Grunon May 1972 37 p refs In GERMAN
(Rept-7/72) Avail: NTIS HC $4.00

The reflection of shock waves on ridged surfaces was investigated in view of studying aerial explosion effects on the earth's surface. The shock wave is reflected in several directions on the differently oriented surface parts, and diffracted on the edges of the ridge, so that a diffuse reflection is produced for a single shock wave. Apart from reflected waves, the surface waves along the wall are also of interest. These undergo an attenuation from the ridges, resulting in a curvature of the shock wave. Several types of flatly and deeply ridged surface profiles were investigated including: sawtooth, combs, and corrugations. It was found that with narrow, deep ridges unexpectedly high reflection pressures are attained at the bottom, whereas with flat ridges, a diffuse reflection with a broad reflection area is produced. In both cases, the generation of the Mach shock is prevented. ESRO

N73-24306# Institut Aerotechnique de Saint-Cyr, Saint- Cyr-l'Ecole (France).
INFLUENCE OF BOUNDARY LAYER ON BLOCKING PHENOMENA [INFLUENCE DES COUCHES LIMITES DES PAROIS DE SOUFFLERIE SUR LES PHENOMENES DE BLOCAGE]
M. Langot, R. Lachaize, and M. Menard Paris Soc. Natl. Ind. Aerospataile 1972 51 p refs In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and Saint-Cyr-l'Ecole, France, 9 Nov. 1972
Avail: NTIS HC $4.75

A theoretical study of wind tunnel boundary layer influence on blocking is made using flow about simple geometrical bodies. Attempts are also made to varify experimentally the evolution of physical blocking phenomena that is identical to theoretical provisions. Transl. by E.H.W.

N73-24307# Technische Hochschule, Aachen (West Germany). Inst. fuer Luft- und Raumfahrt-Stosswellen-Laboratorium.
INVESTIGATION OF SHOCK WAVE INTERACTION IN DOUBLE SHOCK TUBE [UNTERSUCHUNG DER WECHSELWIRKUNG VON STOSSWELLEN IM DOPPELSTOSSROHR]
H. Groenig Bonn Bundesmin. fuer Bildung und Wiss. Dec. 1971 46 p refs
(BMVg-FBWT-72-35) Avail: NTIS HC $4.50

Investigations of the reflection of plane shock waves on plane walls, parallel to the initial shock, have shown that the influence of the wall seems to be more effective then previously assumed. It is demonstrated that the influence of the wall may completely be eliminated by the collision of equally strong shock waves. This may be achieved in a new type of shock tube where two high pressure sections enclose the low pressure section. The diaphragms of both drivers are simultaneously ruptured by means of an exploding wire technique. Thus shock waves of essentially the same strength are produced, which can be observed by a schlieren system within a test section located at the center of the low pressure section. Preliminary results show a good reproducibility of the experiments which agree within the usual errors with theory. Author

N73-24308# National Aerospace Lab., Tokyo (Japan).
SOME CHARACTERISTICS OF THE ARC-HEATER, NOZZLE FLOW, AND THE UNDEREXPANDED JET IN THE NAL 60 kW PLASMA WIND TUNNEL
Riichi Matsuzaki and Noriaki Hirabayashi 1972 23 p refs In JAPANESE; ENGLISH summary
(NAL-TR-307) Avail: NTIS HC $3.25

Some characteristics of the 60 kW plasma wind tunnel have been investigated. The plasma wind tunnel consists of an arc heater, convergent-divergent nozzle, and an under-expanded jet. The thermodynamical flow properties of the working gases in each section have been experimentally and theoretically studied. In the plenum chamber of the arc heater a thermal equilibrium can be assumed. The heat loss in the arc heater has been studied theoretically. The result is found to agree qualitatively with the experiment. Taking account of the effect of ionization-recombination non-equilibrium, the convergent-divergent nozzle flow has been studied. It is shown that the most of the flow field is that of a frozen flow. But the real gas effects have been shown to decrease the flow velocity in the expansion process. A moderately under-expanded jet in the test section has been investigated by the use of a pitot impact pressure tube and an electrostatic probe. In the region inside an intercepting compression wave, it can be approximately said that a uniform flow field prevails. Author

N73-24309*# Louisiana State Univ., Baton Rouge.
ABLATION AND RADIATION COUPLED VISCOUS HYPERSONIC SHOCK LAYERS, VOLUME 1
Carl D. Engel Oct. 1971 388 p refs
(Grant NGR-19-001-059)
(NASA-CR-112306) Avail: NTIS HC $21.50 CSCL 20D

The results for a stagnation-line analysis of the radiative heating of a phenolic-nylon ablator are presented. The analysis includes flow field coupling with the ablator surface, equilibrium chemistry, a step-function diffusion model and a coupled line and continuum radiation calculation. This report serves as the documentation, i e. users manual and operating instructions for the computer programs listed in the report. Author

N73-24310*# Louisiana State Univ., Baton Rouge.
ABLATION AND RADIATION COUPLED VISCOUS HYPERSONIC SHOCK LAYERS, VOLUME 2
Carl D. Engel Oct. 1971 271 p ref
(Grant NGR-19-001-059)
(NASA-CR-112307) Avail: NTIS HC $15.75 CSCL 20D

A computer program can be used to determine the radiative flux and flux divergence through a nonisothermal planar slab of gas is described. The program considers species typical of air at high temperatures and nylon or carbon phenolic ablation products. The equations solved are for a variable optical depth line and continuum gas model using species cross sections and line widths as the basic data. Author

N73-24311*# Cornell Univ., Ithaca, N.Y.
NEARLY SPHERICAL CONSTANT POWER DETONATION WAVES DRIVEN BY FOCUSED RADIATION
Yves Henri George Washington NASA Apr. 1973 100 p refs
(Grant NGL-33-010-042)
(NASA-CR-2230) Avail: NTIS HC $3.00 CSCL 20D

Shape and inner flow of a tridimensional spark are studied. The spark is created by focusing a laser beam in a gas. A second order fully non-linear equation is derived for the radial velocity on the axis of symmetry in the neighborhood of the origin. Solutions to that equation display the existence of a forbidden region near the focus, thus indicating the limits of applicability of a small perturbation solution. Author

N73-24312*# Lockheed-Georgia Co., Marietta.
HIGH SPEED FLOW PAST WINGS
Helge Norstrud Washington NASA Apr. 1973 97 p refs
(Contract NAS1-10665)
(NASA-CR-2246) Avail: NTIS HC $3.00 CSCL 20D

The analytical solution to the transonic small perturbation equation which describes steady compressible flow past finite wings at subsonic speeds can be expressed as a nonlinear integral equation with the perturbation velocity potential as the unknown function. This known formulation is substituted by a system of nonlinear algebraic equations to which various methods are applicable for its solution. Due to the presence of mathematical discontinuities in the flow solutions, however, a main computational difficulty was to ensure uniqueness of the solutions when local velocities on the wing exceeded the speed of sound. For continuous solutions this was achieved by embedding the algebraic system in a one-parameter operator homotopy in order to apply the method of parametric differentiation. The solution to the

initial system of equations appears then as a solution to a Cauchy problem where the initial condition is related to the accompanying incompressible flow solution. In using this technique, however, a continuous dependence of the solution development on the initial data is lost when the solution reaches the minimum bifurcation point. A steepest descent iteration technique was therefore, added to the computational scheme for the calculation of discontinuous flow solutions. Results for purely subsonic flows and supersonic flows with and without compression shocks are given and compared with other available theoretical solutions.
Author

N73-24313*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
USERS MANUAL FOR STREAMTUBE CURVATURE ANALYSIS: ANALYTICAL METHOD FOR PREDICTING THE PRESSURE DISTRIBUTION ABOUT A NACELLE AT TRANSONIC SPEEDS, VOLUME 1
J. S. Keith, D. R. Ferguson, and P. H. Heck Dec. 1972 219 p refs
(Contract NAS1-10804)
(NASA-CR-112239-1) Avail: NTIS HC $13.00 CSCL 20D

The computer program, Streamtube Curvature Analysis, is described for the engineering user and for the programmer. The user oriented documentation includes a description of the mathematical governing equations, their use in the solution, and the method of solution. The general logical flow of the program is outlined and detailed instructions for program usage and operation are explained. General procedures for program use and the program capabilities and limitations are described. From the standpoint of the grammar, the overlay structure of the program is described. The various storage tables are defined and their uses explained. The input and output are discussed in detail. The program listing includes numerous comments so that the logical flow within the program is easily followed. A test case showing input data and output format is included as well as an error printout description.
Author

N73-24314*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
USERS MANUAL FOR STREAMTUBE CURVATURE ANALYSIS: ANALYTICAL METHOD FOR PREDICTING THE PRESSURE DISTRIBUTION ABOUT A NACELLE AT TRANSONIC SPEEDS, VOLUME 2
D. R. Ferguson Dec. 1972 32 p refs
(Contract NAS1-10804)
(NASA-CR-112239-2) Avail: NTIS HC $3.75 CSCL 20D

A special version of the Streamtube Curvature Analysis (STC) was been constructed to include a detached bow shock upstream of a plane or axisymmetric inlet. The bow wave is modeled using the method of Moeckel in conjunction with an approximate definition of the shock stand-off distance. A description of the Moeckel method and its implementation in the STC program are given.
Author

N73-24315*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
USER MANUAL FOR STREAMTUBE CURVATURE ANALYSIS: ANALYTICAL METHOD FOR PREDICTING THE PRESSURE DISTRIBUTION ABOUT A NACELLE AT TRANSONIC SPEEDS, APPENDIX
J. S. Keith, D. R. Ferguson, and P. H. Heck [1973] 304 p
(Contract NAS1-10804)
(NASA-CR-112239-3) Avail: NTIS HC $17.75 CSCL 20D

The computer program listing of Streamtube Curvature Analysis is presented. The listing includes explanatory statements and titles so that the program flow is readily discernable. The computer program listing is in CDC FORTRAN 2.3 source language form, except for three subroutines, GETIX, GETRLX, and SAVIX, which are in COMPOSE 1.1 language.
Author

N73-24316*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF INTERNAL FLOW CHARACTERISTICS OF A SMOOTH-DISK WATER-BRAKE DYNAMOMETER
David G. Evans Washington May 1973 52 p refs
(NASA-TN-D-7234; E-7120) Avail: NTIS HC $3.00 CSCL 20D

The principal of absorbing power with an enclosed partially submerged rotating disk through the turbulent viscous shearing of water is discussed. Reference information is used to develop a flow model of the water brake. A method is then presented that uses vector diagrams to relate the effects of rotational flow, through flow, and secondary flow to power absorption. The method is used to describe the operating characteristics of an example 111-cm (43.7-in.) diameter water brake. Correlating performance parameters are developed in a dimensional analysis.
Author

N73-24317*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
FLIGHT-MEASURED BASE PRESSURE COEFFICIENTS FOR THICK BOUNDARY-LAYER FLOW OVER AN AFT-FACING STEP FOR MACH NUMBERS FROM 0.4 TO 2.5
Sheryll A. Goecke Washington May 1973 33 p refs
(NASA-TN-D-7202; H-740) Avail: NTIS HC $3.00 CSCL 20D

A 0.56-inch thick aft-facing step was located 52.1 feet from the leading edge of the left wing of an XB-70 airplane. A boundary-layer rake at a mirror location on the right wing was used to obtain local flow properties. Reynolds numbers were near 10 to the 8th power, resulting in a relatively thick boundary-layer. The momentum thickness ranged from slightly thinner to slightly thicker than the step height. Surface static pressures forward of the step were obtained for Mach numbers near 0.9, 1.5, 2.0, and 2.4. The data were compared with thin boundary-layer results from flight and wind-tunnel experiments and semiempirical relationships. Significant differences were found between the thick and the thin boundary-layer data.
Author

N73-24318*# Linguistic Systems, Inc., Cambridge, Mass.
INTERACTION OF A SONIC BOOM AND A SHEET OF WATER
A. Peter, C. Thery, J. J. Brunner, and F. Schlosser Washington NASA May 1973 56 p refs Transl. into ENGLISH of "Interaction du Bang et d'une Nappe d'eau", Inst. Franco-Allemand de Rech., St. Louis, France, report 31/71, Oct. 1971 52 p
(Contract NASw-2482)
(NASA-TT-F-14917; Rept-31/71) Avail: NTIS HC $5.00 CSCL 20D

A large number of commercial airline supersonic flights will take place over the ocean. Information is sought on the pressure wave transmitted into the ocean from the boom. For this purpose, apparatus was set up to create an N-wave of short duration, and transmission of the sound signal was measured under the free surface of a sheet of water large enough to be considered semi-infinite. Only the vicinity of the free surface is shown to be affected by the boom. The transmitted pressure signal drops to one-tenth of its value at a depth equal to that of half a sound wavelength. The signal's highest frequencies are quickly filtered out and the transmitted waveform is very rounded. Comparison of the frequency spectrum of this wave with that of ambient ocean noise shows that the transmitted signal is hardly distinguishable from the ambient noise.
Author

N73-24319*# Linguistic Systems, Inc., Cambridge, Mass.
THE KUTTA-JOUKOWSKY CONDITIONS IN THREE-DIMENSIONAL FLOW
Robert Legendre Washington NASA May 1973 24 p refs Transl. into ENGLISH from La Rech. Aerospatiale (French), no. 5, 1972 p 241-247
(Contract NASw-2482)
(NASA-TT-F-14918) Avail: NTIS HC $3.25

The Kutta-Joukowsky condition in three dimensional flow is discussed. The characteristics of the separation line along which a vortex sheet is attached on a wing are examined. From observations of the flow over marine propellers and delta wing models, a discussion is presented to improve the description of the flow over any wing and to provide a better basis for accurate calculations of the perfect fluid flow used as a reference.
Author

N73-24320*# Scripta Technica, Inc., Washington, D.C.
NUMERICAL METHOD OF CHARACTERISTICS CONSIDERING DISSIPATIVE TERMS
W. Koch Washington NASA May 1973 29 p refs Transl.

into ENGLISH from the German report DLR-FB-72-23
(Contract NASw-2484)
(NASA-TT-F-14825; DLR-FB-72-23) Avail: NTIS HC $3.50 CSCL 20D

A numerical method of characteristics considering dissipative terms is developed for unsteady propagation processes. The method is similar to the method described by Ferri for supersonic mixing processes. The dissipative terms are considered as supplementary terms in the equations for a dissipationless system, written in terms of subcharacteristics. These terms can be linearized for weak disturbances and the resulting system of differential equations is conceptually equivalent to Burger's equation, as demonstrated in examples of the piston problem and reflection of a weak shock from a wall. The advantage of the method lies in the clear identification of the region of influence important for numerical stability, although for practical applications the complicated formulation of the equations, particularly with strong shocks, reduces this advantage in comparison with the difference methods. Author

N73-24321# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
TURBULENCE MODELS AND THEIR APPLICATION TO THE PREDICTION OF INTERNAL FLOWS
B. E. Launder and D. B. Spalding Apr. 1971 17 p refs Sponsored by Sci. Res. Council and the CEGB
(TM/TN/A/18) Avail: NTIS HC $3.00

A survey is provided in which available turbulence models are classified according to the nature of the shear stress hypothesis and to the number of turbulence properties which appear as dependent variables of differential conservation equations. Predictions are developed based on two, three, and five equation turbulence models. It is concluded that predicting the majority of internal flows, one of the available two-equation models of turbulence is likely to offer the best balance between accuracy and economy. In addition, a shear-stress equation should be solved when the hydrodynamic boundary conditions are strongly asymmetric. For problems involving combustion, an equation for the concentration fluctuations should also be solved. Author

N73-24322# National Aerospace Lab., Amsterdam (Netherlands).
AN EXPERIMENTAL INVESTIGATION OF THE EFFECT OF THE APPROACHING BOUNDARY LAYER ON THE SEPARATED FLOW BEHIND A DOWNSTREAM-FACING STEP
J. P. Hartzuiker 17 Apr. 1972 32 p refs
(NLR-TR-70033-U) Avail: NTIS HC $3.75

Experiments at Mach 3 show that the pressure in the separated region behind a downstream-facing step changes significantly when the thickness of the approaching boundary layer is varied. The results indicate however that the geometry and dynamics of the dead-air region remain the same. The widely spread-out upstream boundary layers appear to superimpose different pressure levels on the separated region. The growth of the inner part of the mixing layer is unaffected by the variation of upstream boundary-layer thickness. Author

N73-24323*# Scientific Translation Service, Santa Barbara, Calif.
THE RECIRCULATION FLOW PATTERN OF A VTOL LIFTING ENGINE
E. Schwantes Washington NASA Jun. 1973 201 p refs Transl. into ENGLISH from the German report DLR-FB-72-50
(Contract NASw-2483)
(NASA-TT-F-14912; DLR-FB-72-50) Avail: NTIS HC $12.25 CSCL 20D

A method is developed to predict theoretically the increase of temperature due to wind recirculation in the inlet of a VTOL aircraft lift engine exhausting normally to the ground. A method for calculating the velocities in the recirculation flow is presented. The laws of spread of buoyant plumes is used to calculate the temperatures within the recirculated flow. The three regions of the propulsion jet are identified as: (1) the free jet, (2) the wall jet, and (3) the zone of separation of the wall jet from the ground due to wind effects and buoyancy forces. Author

N73-24324*# Aerojet Nuclear Systems Co., Azusa, Calif.
NOZZLE EXTENSION DESIGN STATUS REPORT
L. B. Classer May 1972 104 p Sponsored by NASA
(Proj. 143)
(NASA-CR-132211; N8500:72-143-F-398-7) Avail: NTIS HC $7.25 CSCL 20D

Twenty possible concepts of a possible nozzle/nozzle extension interface were originated. Not all of the concepts were considered worthy of analysis time. Six of them were thermally analyzed and three were stress analyzed. These analyses were done to determine which of the concepts would have the best chance of succeeding, that is, they were a screening process which was to allow rating of one concept against another. This was done because adequate material properties to determine absolute stress levels were not available at the time of the analyses. Though all of the concepts still exhibit some areas of negative margin of safety, concept no. 1 shows good promise that, with slight modifications, it could have all positive margins of safety. Another significant question, regarding these designs, has to do with the Grafoil seals and insulators. Some additional data was just recently received on Grafoil properties, but it was too late to incorporate in the analyses. The new data were not significantly different from the properties which were used.
Author

N73-24325# Howard Univ., Washington, D.C.
NUMERICAL SOLUTION OF THE THREE DIMENSIONAL BOUNDARY LAYER ON A SPINNING SHARP BODY AT ANGLE OF ATTACK
C. B. Watkins, Jr. [1973] 33 p refs Presented at Symp. on Appl. of Computers to Fluid Dyn. Anal. and Design, Farmingdale, N. Y., 3 Jan. 1973 Sponsored by AEC
(SC-CR-72-3182; Conf-730101-1) Avail: NTIS

Numerical solutions for the laminar, compressible, three-dimensional boundary layer on general, sharp bodies of revolution at angle of attack with moderate axial spin are described. Unique solutions to the boundary layer equations are obtained by a finite-difference technique which properly treats the elliptic nature of the flow in a crossflow plane. Results are presented and compared with experiment for a tangent ogive-cylinder at four degrees angle of attack with and without spin. The results indicate that viscous flow solutions for spinning bodies at angle of attack can be obtained within the framework of conventional boundary layer theory. These solutions are free from the anomalies observed in a previous investigation. Author (NSA)

N73-24326# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RADIAL BALANCE IN TURBOMACHINE FLOWS [EQUILIBRE RADIAL DE L'ECOULEMENT DANS UNE TURBOMACHINE]
Robert Legendre Feb. 1973 31 p refs In FRENCH; ENGLISH summary
(ONERA-NT-209) Avail: NTIS HC $3.75

Various methods for the calculation of radial balance in turbomachinery currently used in industry are reviewed. The massic force concept, introduced to represent the action of blading on the fluid is considered too intuitive for accurate results. However, the critical survey based on fluid mechanics equations justifies the use of massic force concept while setting limits on its validity, and leads to the establishment of general equations for the calculation of a reference isentropic flow. It is also shown that it is still more useful to adapt the new calculation to predict the increasing entropy flow crossing the real turbomachine.
ESRO

N73-24327# Rhode Island Univ., Kingston. Dept. of Mechanical Engineering and Applied Mechanics.
A SIMPLIFIED APPROACH TO THE ANALYSIS OF TURBULENT BOUNDARY LAYERS IN TWO AND THREE DIMENSIONS Final Report, Jun. 1971 - Jul. 1972
F. M. White, R. C. Lessmann, and G. H. Christoph Wright-Patterson AFB, Ohio AFFDL Nov. 1972 142 p refs
(Contract F33615-71-C-1585; AF Proj. 1426)
(AD-757871; AFFDL-TR-72-136) Avail: NTIS CSCL 20/4

The report deals with a new method of calculation of coupled skin friction and heat transfer in two-dimensional turbulent boundary layers and also with the calculation of axisymmetric and three-dimensional turbulent skin friction. It is based upon an integral approach which assumes analytic law-of-the-wall velocity and temperature profiles through the boundary layer. The new theory is compared to several important experimental

studies and the general agreement is good. (Author Modified Abstract) GRA

N73-24328# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
NONLINEAR STABILITY OF A LIQUID ADJACENT TO A SUPERSONIC STREAM
Ali H. Nayfeh and Dean T. Mook Nov. 1972 18 p refs
(Contract N00014-72-A-0136-0002; NR Proj. 061-201)
(AD-758103; VPI-E-72-25) Avail: NTIS CSCL 20/4

A nonlinear analysis is presented for the stability of an inviscid semi-infinite liquid layer adjacent to an inviscid gas moving with a uniform supersonic velocity parallel to the liquid/gas interface. The results show that all disturbances are unstable, as in the linear theory. Moreover, the growth rates of all disturbances increase with increasing amplitude. Author (GRA)

N73-24329# Rhode Island Univ., Kingston. Dept. of Mechanical Engineering and Applied Mechanics.
RAPID ENGINEERING CALCULATION OF TWO-DIMENSIONAL TURBULENT SKIN FRICTION, SUPPLEMENT 1 Technical Report, 1 Jun. 1971 - 30 Jun. 1972
Frank M. White and George H. Christoph Nov. 1972 34 p refs
(Contract F33615-71-C-1585; AF Proj. 1426)
(AD-757872; AFFDL-TR-72-136-Suppl-1) Avail: NTIS CSCL 20/4

The report outlines the details for engineering use of White's two-dimensional theory of turbulent skin friction under arbitrary compressible flow conditions. The new method is not only simple but accurate. It is recommended for general use by engineering designers. The method concerns skin friction only. The report presents methods for hand or digital computer computation. Several examples are presented. (Author Modified Abstract) GRA

N73-24330# Naval Research Lab., Washington, D.C.
MIXED REGION COLLAPSE IN A STRATIFIED FLUID Final Report
T. H. Bell, Jr. and J. P. Dugan Mar. 1973 19 p refs
(WF11125703)
(AD-757995; NRL-MR-2564) Avail: NTIS CSCL 20/4

The collapse of a homogeneous fluid mass immersed in a vertically stratified fluid is studied analytically. Simple approximate theories are given for initial and intermediate stages of the process and the predictions agree well with a previous experiment. The theory shows that a previous approximate solution of the problem is deficient. The energy content of the mixed region versus time is traced; the mixed region gives up most of its energy to the surrounding fluid in one Brunt-Vaisala period. Author (GRA)

N73-24331# Army Foreign Science and Technology Center, Charlottesville, Va.
OSCILLATIONS OF A LIQUID NEAR AN INCLINED BOTTOM
V. F. Vityuk and V. Kh. Kirillov 17 Jan. 1973 7 p refs
Transl. into ENGLISH from Materialy Konf. po Kraevym Zadacham (Kazan), 1970
(AD-758251; FSTC-HT-23-253-73) Avail: NTIS CSCL 20/4

The problem of wave motion of a heavy incompressible liquid is solved for the velocity potential and the surface by a perturbation method using Green's functions constructed by Stretenskiy. Author (GRA)

N73-24332# Naval Intelligence Support Center, Washington, D.C. Translation Div.
SEA GOING HYDROFOIL TAYFUN EQUIPPED WITH AUTOMATICALLY CONTROLLED FOILS
I. Ya. Baskakov and V. M. Burkakov 2 Apr. 1973 11 p ref
Transl. into ENGLISH from Sudostroyeniye (Leningrad), no. 10, 1971 p 3-8
(AD-758286; NISC-Trans-3330(A)) Avail: NTIS CSCL 13/10

An automatic motion stabilization system controlling foil lift used to improve sea-keeping abilities of the hydrofoil. Curves of the inverse quality factor R/D of the Tayfun and Kometa hydrofoil models are presented in graphical form. Amplitudes of rolling hydrolfoils as a function of relative bearing in operational speed mode are included, along with diagrams of the various control systems. J.A.M.

N73-24333# Oklahoma State Univ., Stillwater. Fluid Power Research Center.
HYDRAULIC SYSTEM NOISE STUDY. ANNUAL REPORT, SECTION 3, 1 OCTOBER 1970 - 1 SEPTEMBER 1972
Sep. 1972 114 p refs
(Contracts DAAK02-71-C-0074; DAAK02-72-C-0172)
(AD-757776; OSU-FPRC-2M3) Avail: NTIS CSCL 13/7

The purpose of the OSU-MERDC Hydraulic Specification Program is to develop industrially acceptable test procedures and requirement specifications relative to the performance of hydraulic components and systems to facilitate the military's buy-commercial approach. Although the program has been aimed toward components and systems for future 3000 psi operating pressure levels, it was intended that the test procedures be applicable to any pressure level. The report presents a detailed account of the experimental verification part of the hydraulic noise study. Test procedures for hydraulic component noise, developed under this contract, are presented and experimentally verified. The preliminary results of a measurement survey of airborne pump noise, supported by an extension of the contract, are presented and compared with published sound power levels for pumps. Specific recommendations are made for continuing the effort to understand and control hydraulic noise. Author (GRA)

N73-24334# Illinois Inst. of Tech., Chicago. Dept. of Mechanics Mechanical and Aerospace Engineering.
STARTING VORTEX, SEPARATION BUBBLE AND STALL: A NUMERICAL STUDY OF LAMINAR UNSTEADY FLOW AROUND AN AIRFOIL
Unmeel B. Mehta and Zalman Lavan Dec. 1972 275 p refs
(Contract F44620-69-C-0022; AF Proj. 9560)
(AD-758831; THEMIS-IIT-TR-R-72-11; AFOSR-73-0640TR)
Avail: NTIS CSCL 20/4

The stalling characteristics of an airfoil in laminar viscous incompressible fluid are investigated. The governing equations in terms of vorticity and stream function are solved utilizing an implicit finite difference scheme and point successive relaxation procedures. The development of the impulsively started flow, the initial generation of the circulation and the behavior of the forces at large time are studied with emphasis on the formation region. Following incipient separation, the lift increases due to enlargement of a separation bubble and intensification of the flow rotation in it. The extension of this bubble and beyond the trailing edge causes its rupture and brings about the stalling characteristics of the airfoil. The lift increases when attached clockwise bubbles grow and anti-clockwise bubbles are swept away and vice versa. (Author Modified Abstract) GRA

N73-23997 Oxford Univ. (England). Dept. of Engineering Science.
SOME CONVERGENCE PROBLEMS IN THE NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS
W. G. S. Lester *In* ARC Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 13-22 refs Supersedes QUEL-135; ARC-22069 (For availability see N73-23995 15-01)
(ARC-R/M-3239; QUEL-135; ARC-22069)

N73-23998 Oxford Univ. (England). Dept. of Engineering Science.
THE FLOW PAST A PITOT TUBE AT LOW REYNOLDS NUMBER
W. G. S. Lester *In* ARC Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 23-44 refs Supersedes QUEL-136; ARC-22070 (For availability see N73-23995 15-01)
(ARC-R/M-3240; QUEL-136; ARC-22070)

N73-23999 National Physical Lab., Teddington (England). Aerodynamics Div.
ON THE FLOW IN A REFLECTED SHOCK TUNNEL
D. W. Holder and D. L. Schultz *In* ARC Res. Progr. on Aerodyn. Heating, Airfoils, Wings, and Aircraft during 1960, Vol. 1 1972 p 45-78 refs Supersedes ARC-22152 (For availability see N73-23995 15-01)
(ARC-R/M-3265; ARC-22152)

N73-24012 Ministry of Aviation, London (England).
EFFECTS OF HEAT TRANSFER ON LAMINAR BOUNDARY-

LAYER DEVELOPMENT UNDER PRESSURE GRADIENTS IN COMPRESSIBLE FLOW
R. J. Monaghan *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layer, and Instruments during 1960, Vol. 2 1972 p 763-797 refs Supersedes RAE-Aero-2640; ARC-21974 (For availability see N73-24011 15-01)
(ARC-R/M-3218; RAE-Aero-2640; ARC-21974)

N73-24013 Queen Mary Coll., London (England). Dept. of Aeronautical Engineering.
GENERALISED METHODS FOR THE CALCULATION OF THE LAMINAR COMPRESSIBLE BOUNDARY-LAYER CHARACTERISTICS WITH HEAT TRANSFER AND NON-UNIFORM PRESSURE DISTRIBUTION
R. E. Luxton and A. D. Young *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 799-832 refs Previously issued as ARC-20336; ARC-21563 (For availability see N73-24011 15-01)
(ARC-R/M-3233; ARC-20336; ARC-21563)

N73-24021 Ministry of Aviation, London (England).
AN EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER FROM THE INSIDE SURFACE OF A HOT SMOOTH TUBE TO AIR, HELIUM AND CARBON DIOXIDE
J. F. Barnes *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1075-1111 refs Previously issued as NGTE-R241; ARC-21991 (For availability see N73-24011 15-01)
(ARC-R/M-3246; NGTE-R-241; ARC-21991)

N73-24023 Ministry of Aviation, London (England).
THE HEMISPHERICAL, DIFFERENTIAL PRESSURE YAW-METER AT SUPERSONIC SPEED
L. J. Beecham *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1213-1230 refs Previously issued as RAE-TN-Aero; ARC-22184 (For availability see N73-24011 15-01)
(ARC-R/M-3237; RAE-TN-Aero-2687; ARC-22184)

N73-24025 National Physical Lab., Teddington (England). Aerodynamics Div.
TURBULENT WALL JETS WITH AND WITHOUT AN EXTERNAL STREAM
P. Bradshaw and M. T. Gee *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1247-1294 refs Previously issued as ARC-22008 (For availability see N73-24011 15-01)
(ARC-R/M-3252; ARC-22008)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N73-24335 Oklahoma Univ., Norman.
GRAVITY'S EFFECT ON POLARIZATION Ph.D. Thesis
Indresh Hari Dwivedi 1972 57 p
Avail: Univ. Microfilms Order No. 72-29877

According to geometrical optics, a plane of circularly polarized wave at the source will remain plane or circularly polarized as it propagates through a curved space time. However, according to the first order correction to geometrical optics the gravitational field does alter the polarization of the wave. The effect is proportional to the shear introduced into the light rays by the gravitational field. Several applications were tried, the first of which was with light coming from a dense star. The conclusion was that due to the size of the antenna it was not possible to detect any polarization changes, even when the light observed is focused by the gravitational field of the star. The next application was with light coming from the late stages of a collapsing star. Here the measurable effect lasted for such a short period of time it was not measurable. The final case was that of black body radiation passing near a inhomogeneity before reaching an antenna fixed on the earth. Again the measurable effect lasted for such a short duration that it was not measurable.
Dissert. Abstr.

N73-24336 Stanford Univ., Calif.
SHORT GEOMAGNETIC POLARITY INTERVALS IN MARINE MAGNETIC PROFILES Ph.D. Thesis
Richard Jay Blakley 1972 68 p
Avail: Univ. Microfilms Order No. 72-30592

A method is presented which permits marine magnetic anomaly profiles from all parts of the world to be stacked for the purpose of enhancing coherent small anomalies due to short geomagnetic polarity events. In general, the shape of a profile depends not only on the sequence of normally and reversely magnetized magnetic prisms which constitute the source, but also on the following five angles: the declination and inclination of the regional field; the declination and inclination of the magnetization; and the azimuth of the magnetic stripes. This method transforms a measured anomaly to a second anomaly which would have been produced by an identical source with vertical magnetization and vertical regional field. The method uses Fourier transforms and linear systems theory and employs filters with a flat spectral response, so that no informations is lost at short wavelengths.
Dissert. Abstr.

N73-24337 Rice Univ., Houston, Tex.
COASTAL PROCESSES UNDER HURRICANE ACTION: NUMERICAL SIMULATION OF A FREE-BOUNDARY SHORELINE Ph.D. Thesis
Peter William Sloss 1972 145 p
Avail: Univ. Microfilms Order No. 72-26475

The horizontal momentum transport equations are integrated numerically by pointwise overrelaxation methods to produce predicted fields of horizontal motion and free-surface displacement for a body of water under hurricane action. Water motions are driven by barometric pressure gradients and quadratic wind stress and retarded by quadratic drag at the bottom. The free water surface is displaced in response to the divergence of the horizontal volume transport and by hydrostatic adjustment to atmospheric pressure. Treatment of lateral boundaries of the fluid region differs from previous studies in that while a no-slip boundary condition is assumed for the edges of the computer data grid, the model shoreline within the grid is free to advance or retreat as the surge level changes. The model provides an estimate of the maximum current speed at the sea bottom by adding the surge-generated drift current to the peak bottom current generated by waves of significant height appropriate to the given model or measured wind field.
Dissert. Abstr.

N73-24338 Stanford Univ., Calif.
VHF/UHF TECHNIQUES FOR THE DETERMINATION OF THE COLUMNAR ELECTRON CONTENTS OF THE PLASMASPHERE AND OF THE PROTONOSPHERE USING GEOSTATIONARY SATELLITE TRANSMISSION: OBSERVATIONS DURING MAGNETIC STORMS Ph.D. Thesis
Odmar Geraldo Alemeida 1972 95 p
Avail: Univ. Microfilms Order No. 72-30583

Measurements of the total electron content of the plasmasphere up to geostationary heights have been made using the beacon transmitters aboard the satellite ATS-3. The technique employed is a combination of the phase-path length difference and the Faraday rotation angle methods. Such a combination permits very accurate determination of the integration constant necessary to convert phase-path length difference data into information about the absolute value of the columnar content. The data taken using the ATS-3 satellite are presented and interpreted in terms of changes in electron content of the upper plasmasphere.
Dissert. Abstr.

N73-24339 Florida State Univ., Tallahassee.
A NEW LONGWAVE RADIATIVE TRANSFER MODEL: CALIBRATION AND APPLICATION TO THE TROPICAL ATMOSPHERE Ph.D. Thesis
Robert George Ellingson 1972 366 p
Avail: Univ. Microfilms Order No. 72-27913

The active bands taken into account by the model include the pure rotational water vapor, the 6.3 microns water vapor, the 15 microns carbon dioxide, the 14 microns ozone, the 9.6

microns ozone, the 7.66 microns methane, and the 7.78 microns nitrous oxide band systems. The water vapor continuum is included in the manner of Bignell. The model has a variable spectral resolution ranging from 3 to 40 1/cm. Comparisons of Nimbus 3 IRIS intensity spectra with theoretical calculations using near simultaneous meteorological data on clear days over the BOMEX array show agreement to better than 10 percent in all spectral regions from 400 to 1400 1/cm. The difference between the frequency integrated IRIS observations and theoretical calculations from 400 to 1400 1/cm, combined with pessimistic estimates of the errors outside of this interval, indicates that the upward flux calculations are correct to within + or - 1.3 percent. Dissert. Abstr.

N73-24340 Michigan Univ., Ann Arbor.
THE DISTRIBUTION OF TROPOSPHERIC INFRARED RADIATIVE FLUXES AND ASSOCIATED HEATING AND COOLING RATES IN THE SOUTHERN HEMISPHERE Ph.D. Thesis
Frank David Haurwitz 1972 180 p
Avail: Univ. Microfilms Order No. 72-29083

The results of infrared flux calculations carried out for the hemisphere for climatological conditions for January and July are presented. The results are given in terms of the resultant heating and cooling rates, the fluxes at the top of the atmosphere, and the next flux divergences for the entire atmospheric column. The 6.3 and 80 micron water vapor, the 15 micron carbon dioxide, and the 9.6 micron ozone bands are considered and transmission functions determined from the quasi-random band model, with the exception of the ozone band, for which Walshaw's empirical formula is used. The calculated transmissivities are compared to experimental values and fall within their experimental uncertainties. Dissert. Abstr.

N73-24341 Washington Univ., Seattle.
THE STRUCTURE AND DYNAMICS OF THE HORIZONAL ROLL VORTICES IN THE PLANETARY BOUNDARY LAYER Ph.D. Thesis
Margaret Anne Lemone 1972 144 p
Avail: Univ. Microfilms Order No. 72-28625

The wind and temperature fields of the planetary boundary layer are investigated during periods in which horizontal roll vortices are present. Measurements from a 444 meter tower and from inertially-stabilized aircraft indicate the rolls are maintained primarily by: (1) production of energy from the crossroll component of the mean PBL wind spiral (lateral instability), and (2) bouyancy. Although aircraft data indicate a systematic concentration of turbulence in the positive vertical velocity regions of rolls, the effect of turbulence on the roll energy budget seems small. Both tower and aircraft measurements indicate substantial heat flux by rolls. It is shown that including positive roll heat flux into Brown's equilibrium energy budget will lead to rolls of larger magnitude. Dissert. Abstr.

N73-24342 Washington Univ., Seattle.
BUDGETS OF TRUBULENT ENERGY AND TEMPERATURE VARIANCE IN THE TRANSITION ZONE FROM FORCED TO FREE CONVECTION Ph.D. Thesis
Nobutaka Monji 1972 134 p
Avail: Univ. Microfilms Order No. 72-28637

Transition from the surface layer to the free convection layer of the unstable atmospheric boundary layer is discussed mainly from the standpoint of the budget relations of thermal variance and kinetic energy. The data used cover a wide range of stability for unstable conditions obtained over the Bonneville Salt Flats, Utah in 1970. The terms appearing in the budget equations seem to obey the Obukhov's similarity law. The thermal variance transport term changes the sign from divergence to convergence. This variation approximately agrees with that of the difference between the production and the dissipation terms throughout the analyzed stability range. Dissipation rates of kinetic energy and temperature of fluctuations are well related to the spectral peak wavelength. Dissert. Abstr.

N73-24343 Michigan Univ., Ann Arbor.
VERTICAL AND TEMPORAL VARIATIONS OF TRACE ELEMENTS IN SURFACE AIR Ph.D. Thesis
Ronald Link Lininger 1972 222 p
Avail: Univ. Microfilms Order No. 72-29136

Variations in solid phase trace-element aerosol concentrations, as functions of time and height, in the lowest 34 meters of the atmosphere are examined. The sampling location-the Argonne National Laboratories meteorological tower-exhibits semiurban pollution levels and also affords meteorological data useful in interpreting results. Neutron activation analyses yield data for the elements Ca, Al, Ti, V, Br, In, I, Cu, Mn, Mg, Na, and Cl. Uncertainties of 20% to 25% are typical. Implications of this work are important in comparing published concentration data based on trace element samples taken at different levels or under different weather conditions. Dissert. Abstr.

N73-24344*# Oregon State Univ., Corvallis. Rangeland Resources Program.
INVENTORY AND MONITORING OF NATURAL VEGETATION AND RELATED RESOURCES IN AN ARID ENVIRONMENT BY THE USE OF ERTS-A IMAGERY Progress Report, 1 Mar. - 30 Apr. 1973
Barry J. Schrumpf, Principal Investigator 30 Apr. 1973 3 p ref ERTS
(Contract NAS5-21831)
(E73-10519; NASA-CR-131482; PR-3) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-24345*# Environmental Research Inst. of Michigan, Ann Arbor.
[ERTS-1 INVESTIGATIONS CONDUCTED BY ENVIRONMENTAL RESEARCH INSTITUTE OF MICHIGAN] Bimonthly Report, 1 Mar. - 30 Apr. 1973
Frederick J. Thomson, Principal Investigator 9 May 1973 18 p Original contain imagery. Original photography may be purchased from EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21783)
(E73-10565; NASA-CR-131651; BMR-5; Rept-193300-13-L) Avail: NTIS HC $3.00 CSCL 05B

Progress is reported for the following tasks: (1) calculation of water depth from ERTS-1 data; (2) terrain classification maps of Yellowstone Park; (3) atmospheric effects on ERTS-1 data; (4) lake ice surveillance using radar imagery; (5) digital land use mapping in Oakland County, Michigan; (6) IFYGL hydrological data for Lake Ontario Basin; (7) image enhancement and advanced information extraction techniques; (8) monitoring water quality and ocean dumping; (9) oil pollution detection; and (10) ratio mapping of iron ore deposits in Atlantic City District, Wyoming. For individual titles, see N73-24346 through N73-24355.

N73-24346* Environmental Research Inst. of Michigan, Ann Arbor.
WATER DEPTH MEASUREMENT, TASK 1
F. C. Polcyn, Principal Investigator *In its* ERTS-1 Invest. conducted by Environ. Res. Inst. of Mich. 9 May 1973 1 p ERTS (For availability see N73-24345 15-13)
(E73-10566) CSCL 08J

There are no author-identified significant results in this report.

N73-24347* Environmental Research Inst. of Michigan, Ann Arbor.
YELLOWSTONE NATIONAL PARK DATA, TASK 2
Frederick J. Thomson, Principal Investigator *In its* ERTS-1 Invest. conducted by Environ. Res. Inst. of Mich. 9 May 1973 1 p ERTS (For availability see N73-24345 15-13)
(E73-10567) CSCL 08B

There are no author-identified significant results in this report.

N73-24348* Environmental Research Inst. of Michigan, Ann Arbor.
ATMOSPHERIC EFFECTS IN ERTS-1 DATA, TASK 3
Frederick J. Thomson, Principal Investigator *In its* ERTS-1 Invest. conducted by Environ. Res. Inst. of Mich. 9 May 1973 1 p ERTS (For availability see N73-24345 15-13)
(E73-10568) CSCL 08B

There are no author-identified significant results in this report.

N73-24349* Environmental Research Inst. of Michigan, Ann Arbor.

LAKE ICE SURVEILLANCE, TASK 4
M. Leonard Bryan, Principal Investigator *In its* ERTS-1 Invest. conducted by Environ. Res. Inst. of Mich. 9 May 1973 1 p ERTS (For availability see N73-24345 15-13)
(E73-10569) CSCL 08L
There are no author-identified significant results in this report.

N73-24350* Environmental Research Inst. of Michigan, Ann Arbor.
RECREATIONAL LAND USE, TASK 5
I. Sattinger, Principal Investigator *In its* ERTS-1 Invest. conducted by Environ. Res. Inst. of Mich. 9 May 1973 1 p ERTS (For availability see N73-24345 15-13)
(E73-10570) CSCL 08B
There are no author-identified significant results in this report.

N73-24351* Environmental Research Inst. of Michigan, Ann Arbor.
IFYGL (LAKE ONTARIO), TASK 6
F. C. Polcyn, Principal Investigator *In its* ERTS-1 Invest. conducted by Environ. Res. Inst. of Mich. 9 May 1973 1 p ERTS (For availability see N73-24345 15-13)
(E73-10571) CSCL 08H
There are no author-identified significant results in this report.

N73-24352* Environmental Research Inst. of Michigan, Ann Arbor.
IMAGE ENHANCEMENT AND ADVANCED INFORMATION EXTRACTION TECHNIQUES, TASK 7
W. A. Malila, Principal Investigator and R. F. Nalepka *In its* ERTS-1 Invest. conducted by Environ. Res. Inst. of Mich. 9 May 1973 3 p ERTS (For availability see N73-24345 15-13)
(E73-10572) CSCL 05B
There are no author-identified significant results in this report.

N73-24353* Environmental Research Inst. of Michigan, Ann Arbor.
WATER QUALITY MONITORING, TASK 8
C. T. Wezernak, Principal Investigator *In its* ERTS-1 Invest. conducted by Environ. Res. Inst. of Mich. 9 May 1973 1 p ERTS (For availability see N73-24345 15-13)
(E73-10573) CSCL 08J
There are no author-identified significant results in this report.

N73-24354* Environmental Research Inst. of Michigan, Ann Arbor.
OIL POLLUTION DETECTION, TASK 9
R. Horvath, Principal Investigator *In its* ERTS-1 Invest. conducted by Environ. Res. Inst. of Mich. 9 May 1973 3 p ERTS (For availability see N73-24345 15-13)
(E73-10574) CSCL 08J
There are no author-identified significant results in this report.

N73-24355* Environmental Research Inst. of Michigan, Ann Arbor.
AN ERTS EXPERIMENT FOR MAPPING IRON COMPOUNDS
R. K. Vincent, Principal Investigator *In its* ERTS-1 Invest. conducted by Environ. Res. Inst. of Mich. 9 May 1973 1 p ERTS (For availability see N73-24345 15-13)
(E73-10575) CSCL 08B
There are no author-identified significant results in this report.

N73-24356*# Stanford Research Inst., Menlo Park, Calif.
STUDY OF TIME LAPSE DATA PROCESSING FOR DYNAMIC HYDROLOGIC CONDITIONS Progress Report, 6 Mar. - 6 May 1973
Sidney M. Serebreny, Principal Investigator 6 May 1973 11 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21841)
(E73-10582; NASA-CR-131898) Avail: NTIS HC $3.00 CSCL 08H
There are no author-identified significant results in this report.

N73-24357*# Mississippi Test Facility, Bay St. Louis.
EVALUATION OF SATELLITE REMOTE SENSING AND AUTOMATIC DATA TECHNIQUES FOR CHARACTERIZATION OF WETLANDS AND MARSHLANDS Progress Report
Robert H. Cartmill, Principal Investigator 8 May 1973 2 p ERTS
(E73-10590; NASA-TM-X-69218) Avail: NTIS HC $3.00 CSCL 08H
There are no author-identified significant results in this report.

N73-24358*# Old Dominion Univ. Research Foundation, Norfolk, Va.
INVESTIGATION TO RELATE THE CHLOROPHYLL AND SUSPENDED SEDIMENT CONTENT IN THE WATERS OF THE LOWER CHESAPEAKE BAY TO ERTS-1 IMAGERY, TASK 2. THE USE OF ERTS-1 TO MORE FULLY UTILIZE AND APPLY MARINE STATION DATA TO THE STUDY OF PRODUCTIVITY ALONG THE EASTERN SHELF EXPANDED WATERS OF THE UNITED STATES Bimonthly Report, 1 Feb. - 31 Mar. 1973
John C. Ludwick, Principal Investigator, H. G. Marshall, Fleischer, Hanna, Gosink, and Bowker 31 Mar. 1973 3 p ERTS
(Contract NAS5-21816)
(E73-10593; NASA-CR-131909) Avail: NTIS HC $3.00 CSCL 08A
There are no author-identified significant results in this report.

N73-24359*# Texas Technological Univ., Lubbock. Remote Sensing Lab.
DYNAMICS OF PLAYA LAKES IN THE TEXAS HIGH PLAINS Progress Report, 1 Apr. - 31 May 1973
C. C. Reeves, Jr., Principal Investigator 31 May 1973 6 p ERTS
(Contract NAS5-21720)
(E73-10598; NASA-CR-131994) Avail: NTIS HC $3.00 CSCL 08H
There are no author-identified significant results in this report.

N73-24360*# Geological Survey, Arlington, Va.
DYNAMICS OF SUSPENDED SEDIMENT PLUMES IN LAKE ONTARIO Progress Report, 1 Mar. - 30 Apr. 1973
Edward J. Pluhowski, Principal Investigator 1 May 1973 3 p ERTS
(NASA Order S-70243-AG-2)
(E73-10599; NASA-CR-131995) Avail: NTIS HC $3.00 CSCL 08H
There are no author-identified significant results in this report.

N73-24361*# Geological Survey, Washington, D.C.
OVERALL EVALUATION OF ERTS IMAGERY FOR CARTOGRAPHIC APPLICATION Progress Report, 1 Mar. - 30 Apr. 1973
Alden P. Colvocoresses, Principal Investigator 1 May 1973 2 p ERTS
(NASA Order S-70243-AG-2)
(E73-10600; NASA-CR-131996) Avail: NTIS HC $3.00 CSCL 08B
The author has identified the following significant results. The apparently successful fitting of a plane coordinate (UTM) grid to an ERTS-1 bulk image represents a breakthrough of potential economic importance. If such results continue to be attained it means that ERTS-1 imagery even in bulk form can be reproduced as planimetric image maps that meet National Map Accuracy Standards up to the 1:250,000 scale. Such maps permit positions of image points to be geodetically defined to within 75 meters (rms). Previous efforts to map with ERTS-1 images resulted in errors approaching 300 meters (rms).

N73-24362*# Geological Survey, Menlo Park, Calif.
REMOTE SENSING OF PERMAFROST AND GEOLOGIC HAZARDS IN ALASKA Progress Report, 1 Mar. - 30 Apr. 1973
Oscar J. Ferrians, Jr., Principal Investigator 1 May 1973 3 p ERTS
(NASA Order S-70243-AG-2)
(E73-10601; NASA-CR-131997) Avail: NTIS HC $3.00 CSCL 08L
There are no author-identified significant results in this report.

N73-24363*# Geological Survey, Washington, D.C.
INVESTIGATION OF ERTS/RBV IMAGERY FOR PHOTO-

MAPPING OF THE UNITED STATES Progress Report, 1 Mar. 1973 - 30 Apr. 1973
Joseph Pilonero, Principal Investigator 1 May 1973 2 p ERTS
(NASA Order S-70243-AG)
(E73-10602; NASA-CR-131998) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-24364*# Delaware Univ., Newark.
DYNAMICS OF PLANKTON POPULATIONS IN UPWELLING AREAS
Karl-Heinz Szekielda, Principal Investigator May 1973 11 p ERTS
(Contract NAS5-21784)
(E73-10603; NASA-CR-131999) Avail: NTIS HC $3.00 CSCL 08A

There are no author-identified significant results in this report.

N73-24365*# Science Applications, Inc., Ann Arbor, Mich.
USE OF SKYLAB EREP DATA IN A SEA SURFACE TEMPERATURE EXPERIMENT Quarterly Report, 17 Feb. - 17 May 1973
David C. Anding, Principal Investigator May 1973 24 p refs EREP
(Contract NAS9-13277)
(E73-10604; NASA-CR-132000; QR-1) Avail: NTIS HC $3.25 CSCL 08J

The author has identified the following significant results. This report discusses an experiment to be performed on each of the three manned Skylab missions, the results of which will assess the ability of spaceborne infrared multispectral sensing to function as a means of providing improved estimates of sea surface temperature over that obtainable with a single channel radiometric instrument. The overall investigative program is outlined, the effort performed during the prelaunch phase is detailed, and pertinent results are presented.

N73-24366*# Brevard County Planning Dept., Titusville, Fla.
PLANNING APPLICATIONS IN EAST CENTRAL FLORIDA Progress Report, 1 Apr. - 31 May 1973
John W. Hannah, Garland L. Thomas, and Fernando Esparza, Principal Investigators 31 May 1973 20 p ERTS
(Contract NAS5-21847)
(E73-10605; NASA-CR 132002) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-24367*# Nevada Univ., Reno.
USE OF SATELLITE IMAGERY FOR WILDLAND RESOURCE EVALUATION IN THE GREAT BASIN Progress Report
Paul T. Tueller, Principal Investigator Mar. 1973 6 p ERTS
(Contract NAS5-21870)
(E73-10606; NASA-CR-132003) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. Color composites and diazachrome transparencies of ERTS-1 imagery have greatly increased interpretation capabilities. Vegetation green-up and flooding due to late summer precipitation has been identified on such imagery. MSS imagery in all bands has not proven as valuable for similar determinations. Snow cover has been found to be valuable in the identification of fire scars, pinyon/juniper chainings, and subtle ecotones not previously identified with any other type of imagery. It is felt that a greater understanding of the effects of snow cover on vegetation remote sensing will enable investigators to extend capabilities relating to the mapping and identification of these resources. Highly reflective phreatophytic vegetation has been mapped and quantified using the MSS 5 and 7 bands and diazachrome color composites. Approximately 10 man-hours were required to complete the entire state. Native meadow and hay meadow vegetation has been mapped in Elko County, Nevada, using ERTS-1 imagery. Future plans include a statewide inventory of this resource.

N73-24368*# Oceanographic Services, Inc., Santa Barbara, Calif.
ACQUISITION AND ANALYSIS OF COASTAL GROUND TRUTH DATA FOR CORRELATION WITH ERTS-1 IMAGERY Bimonthly Progress Report
William A. Anikouchine, Principal Investigator 4 Jun. 1973 8 p ERTS
(Contract NAS5-21877)
(E73-10607; NASA-CR-132004; BMPR-3) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-24369*# Colorado School of Mines, Golden. Dept. of Geology.
GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO USING ERTS-1 DATA Progress Report, Dec. 1972 - May 1973
Daniel H. Knepper, comp. May 1973 31 p refs ERTS
(Contract NAS5-21778)
(E73-10608; NASA-CR-132005; PR-6) Avail: NTIS HC $3.75 CSCL 08G

The author has identified the following significant results. Geologic interpretation of ERTS-1 imagery is dependent on recognition of the distribution, continuity, trend, and geometry of key surface features. In the examination of ERTS-1 imagery, lithology must be interpreted largely from the geomorphic expression of the terrain. ERTS-1 imagery is extremely useful in detecting local structures. Most mapped structures are topographically-expressed. Consequently, ERTS-1 imagery acquired during mid-winter, when the solar illumination angle is low, provides the largest amount of structural information. Stereoscopic analyses of ERTS-1 images significantly aid geologic interpretation. Positive transparencies of ERTS-1 images (1:1,000,000) commonly contain more geologic information than can be adequately annotated during geologic interpretation.

N73-24370*# Headquarters US Army IAGS for EROS Guatemala, APO New York.
INVESTIGATION OF THE UTILITY OF ERTS-1 IMAGERY FOR UPDATING LAND USE AND RESOURCE DATA IN GUATEMALA Progress Report, Jul. 1972 - Mar. 1973
Luis E. Garcia, Principal Investigator 10 Apr. 1973 52 p
Sponsored by NASA ERTS
(E73-10609; NASA-CR-132006) Avail: NTIS HC $4.75 CSCL 08B

The author has identified the following significant results. An intensive analysis of the imagery received has been completed and findings are reported. Conclusions are restricted by receipt of only limited amounts of cloud-free coverage of test areas. In most cases the interpretation findings were as anticipated from previous experience with multiband images. Band 7 provides promising indication of some economically important environmental communities. It also permits viewing through thin cirrus cloud layers for features of medium to high contrast. Band 4 provides information of submerged reefs and of movement of suspended sediment bodies in water areas. ERTS-1 bulk images have positional mapping accuracy adequate for representation at 1:1,000,000 scale maps. Cloud cover is a true constraint to useable satellite coverage.

N73-24371*# Earth Satellite Corp., Berkeley, Calif.
EVALUATION OF USEFULNESS OF SKYLAB EREP S-190 AND S-192 IMAGERY IN MULTISTAGE FOREST SURVEYS Progress Report, 1 Apr. - 31 May 1973
Philip G. Langley, Principal Investigator 31 May 1973 5 p EREP
(Contract NAS9-13289)
(E73-10610; NASA-CR-132007) Avail: NTIS HC $3.00 CSCL 02F

The author has identified the following significant results. A set of digital interpretation programs have been developed which perform the following tasks: (1) extraction of images for a desired sample unit or combination of sample units by scanner channel and storage of these images on high speed storage devices; (2) extraction of tone and texture information of 8 x 8 pixel interpretation units by channel and storage of these features on a high speed storage device; (3) center of gravity cluster node seeking in higher dimensional space and subsequent nearest neighbor classification, and output of the classification results on a high speed storage device. In all instances the classification results can be related to the original place of subset extraction through the coordinate transformation work previously performed.

N73-24372*# Maine Dept. of Transportation, Augusta.
DETECTION AND MONITORING VEGETATION DAMAGE ASSOCIATED WITH HIGHWAYS AND HIGHWAY FACILITIES Interim Report, Nov. 1972 - May 1973
Ernest G. Stoeckeler, Principal Investigator May 1973 6 p ERTS
(Contract NAS5-21724)
(E73-10611; NASA-CR-132008) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-24373*# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
REMOTE SENSING OF OCEAN CURRENTS Interim Report, Nov. 1972 - May 1973
George A. Maul, Principal Investigator May 1973 26 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70246-AG)
(E73-10612; NASA-CR-132009) Avail: NTIS HC $3.50 CSCL 08C

The author has identified the following significant results. Monthly field experiments in support of the NOAA investigation of ocean color boundary determination using ERTS-1 data have been conducted since June 1972. The boundary between coastal waters and the Loop Current has been detected by ERTS-1 as a result of sea state changes as well as color differences. Ocean information is contained in all 24 channels of the Bendix MSS flown on the C-130 in June 1972; this includes UV, visible, reflected IR, and emitted IR. Computer enhancement of MSS data is revealing many features not shown in the NDPF product.

N73-24374*# Tulane Univ., New Orleans, La.
PRELIMINARY STUDY OF LAKE PONTCHARTRAIN AND VICINITY USING REMOTELY SENSED DATA FROM THE ERTS-A SATELLITE Progress Report
John U. Hidalgo, Principal Investigator, Alfred E. Smalley, Kenneth H. Faller, and Mary B. Irvin 15 May 1973 6 p ERTS
(Contract NAS5-21740)
(E73-10613; NASA-CR-132010) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. During the summer of 1972, huge mats of duckweeds (Lemnaceae) appeared on Lake Pontchartrain, a shallow estuary in southeastern Louisiana. In color infrared photography, duckweeds show a characteristic light lavender color, unlike algal mats or water hyacinth, as observed in low level aerial photography. Although at least five species are present in the area, most water coverage is by Lemna minor and Spirodela oligorrhiza. ERTS-1 imagery shows many areas of bayous, swamps, and marginal waters of Lake Pontchartrain covered with duckweeds. Subsequent passes show a seasonal decreases in duckweeds.

N73-24375*# Servicio Geologico de Bolivia, La Paz.
APPLICATION OF ERTS IMAGERY TO GEOLOGICAL MAPPING [APLICACION DE IMAGENES ERTS ALMAPEO GEOLOGICO]
Alvaro Fernandez, Oscar Aranibar, and Paul Ballon 1973 18 p In SPANISH Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E73-10614; NASA-CR-132011) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. In comparing the interpretation of the imagery with that of photomosaics, the following results were derived. The drainage networks of the RBV images show information in greater detail than the photomosaics, and maps, yet maintain scale differences. However, for the basins the mosaics and maps provide better information. The geomorphology is best interpreted in the images of the ERTS-1, not only for the regional countryside, but also for the morphological formations. It was concluded that the satellite images offer the better possibility for identifying the alignment of joints and faults. In the images the relation is 4 to 1. The considered N-S alignments were identified in both systems with a ratio of 2 to 1. The E-W alignments for the areas considered in the ERTS-1 images show a basic Paleozoic formation not previously detected. Transl. by F.O.S.

N73-24376*# Alaska Univ., Fairbanks.
APPLICATION OF ERTS-1 IMAGERY TO THE STUDY OF CARIBOU MOVEMENTS AND WINTER DISPERSAL IN RELATION TO PREVAILING SNOWCOVER Bimonthly Progress Report
Peter C. Lent, Principal Investigator 8 Jun. 1973 7 p ref ERTS
(Contract NAS5-21833)
(E73-10615; NASA-CR-132026; BMPR-5) Avail: NTIS HC $3.00 CSCL 06C

The author has identified the following significant results. Step-wise discriminate analysis has demonstrated the feasibility of feature identification using linear discriminate functions of ERTS-1 MSS band densities and their ratios. The analysis indicated that features such as small streams can be detected even when they are in dark mountain shadow. The potential utility of this and similar analytic techniques appears considerable, and the limits it can be applied to analysis of ERTS-1 imagery are not yet fully known.

N73-24377*# Alaska Univ., Fairbanks.
EVALUATION OF FEASIBILITY OF MAPPING SEISMICALLY ACTIVE FAULTS IN ALASKA Bimonthly Progress Report
Larry Gedney, Principal Investigator 31 May 1973 3 p refs ERTS
(Contract NAS5-21833)
(E73-10616; NASA-CR-132027; BMPR-5) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-24378*# Alaska Univ., Fairbanks.
CIRCULATION OF PRINCE WILLIAM SOUND Bimonthly Progress Report
Robin D. Muench, Principal Investigator 31 May 1973 2 p ERTS
(Contract NAS5-21833)
(E73-10617; NASA-CR-132028; BMPR-5) Avail: NTIS HC $3.00 CSCL 08C

There are no author-identified significant results in this report.

N73-24379*# Alaska Univ., Palmer.
IDENTIFICATION OF PHENOLOGICAL STAGES AND VEGETATIVE TYPES FOR LAND USE CLASSIFICATION Bimonthly Progress Report
Ivan Branton, Principal Investigator 1 Jun. 1973 6 p ERTS
(Contract NAS5-21833)
(E73-10618; NASA-CR-132029; BMPR-5) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. A large grassland was located on the Kenai Peninsula which may be a potential grazing land. Two 1:250,000 vegetation maps were constructed from ERTS-1 scenes 1049-20505 and 1066-20453 using 70 mm MSS chips and black and white prints for an area of 3.5 million acres. Another area (464,000 acres) was mapped using digital data. The latter map is the most accurate and detailed vegetation map of that area produced to date. Areal extents of identified vegetation types were derived for the area mapped from digital data. Early spring (prior to leafing out of the deciduous trees) is suspected as being the best time for mapping Alaskan vegetation from MSS data due to the radiometrically distinctness of the vegetation communities at that time.

N73-24380*# Alaska Univ., Fairbanks.
BREAK-UP CHARACTERISTICS OF CHENA RIVER BASIN Bimonthly Progress Report
Robert F. Carlson, Principal Investigator 31 May 1973 4 p ERTS
(Contract NAS5-21833)
(E73-10619; NASA-CR-132030; BMPR-5) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. Utilization of the Zoom transfer scope enabled the plotting of the snow conditions on topographical maps and the transferring

of the contour lines onto the aerial photographs, so that the snow conditions could be studied for dependence and exposure.

N73-24381*# Alaska Univ., Fairbanks.
SEA ICE AND SURFACE WATER CIRCULATION, ALASKAN CONTINENTAL SHELF Bimonthly Progress Report
Frederick F. Wright, Principal Investigator, G. D. Sharma, and J. J. Burn 30 May 1973 8 p refs ERTS
(Contract NAS5-21833)
(E73-10620; NASA-CR-132031; BMPR-5) Avail: NTIS HC $3.00 CSCL 08C

The author has identified the following significant results. The boundaries of land-fast ice, distribution of pack ice, and major polynya were studied in the vicinity of the Bering Strait. Movement of pack ice during 24 hours was determined by plotting the distinctly identifiable ice floes on ERTS-1 imagery obtained from two consecutive passes. Considerably large shallow area along the western Seward Peninsula just north of the Bering Strait is covered by land fast ice. This ice hinders the movement of ice formed in eastern Chukchi Sea southward through the Bering Strait. The movement of ice along the Russian coast is relatively faster. Plotting of some of the ice floes indicated movement of ice in excess of 30 km in and south of the Bering Strait between 6 and 7 March, 1973. North of the Bering Strait the movement approached 18 km. The movement of ice observed during March 6 and 7 considerably altered the distribution and extent of polynya. These features when continually plotted should be of considerable aid in navigation of ice breakers. The movement of ice will also help delineate the migration and distribution of sea mammals.

N73-24382*# State of Ohio Dept. of Development, Columbus.
RELEVANCE OF ERTS TO THE STATE OF OHIO Progress Report, Apr. - May 1973
David C. Sweet, Principal Investigator May 1973 20 p Prepared for Battelle Columbus Labs., Ohio Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contracts NAS5-21782; BCL-72-27/G-1793)
(E73-10621; NASA-CR-132032) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-24383*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
MAPPING OF THE MAJOR STRUCTURES OF THE AFRICAN RIFT SYSTEM Progress Report, 1 Mar. - 30 Apr. 1973
Paul Mohr, Principal Investigator 30 Apr. 1973 5 p ERTS
(Contract NAS5-21748)
(E73-10622; NASA-CR-132033) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. ERTS-1 imagery of the African rift system has already proved of great value in structural geological studies. One of the interesting megastructures expressed on the imagery occurs some 40 km east of the eastern margin of the main Ethiopian rift, in Arussi province, and extending between latitude 71/2 and 81/4 deg N. The Badda-Encuolo ridge proves to have been a line of major Tertiary volcanism and probably supplied the thick Trap Series flood basalt sequence exposed farther east in the canyons of the Webi Shebeli drainage system. The ridge itself was built up by the waning activity of the Sagatu line of volcanism. Serendipitious has been the discovery on Mt. Badda of several deeply glaciated valleys, many of which show clearly on the ERTS-1 imagery. It seems that Mt. Badda was one of the most important glacial centers in eastern Africa during the Pleistocene. Three major late-Tertiary trachytic centers lie between the Badda-Encuolo ridge and the rift valley. The relationships of these three volcanoes to each other and to the rift faulting is revealed for the first time by the ERTS-1 imagery, as is the form of the cladera of Baltata and the crater of Chilalo.

N73-24384*# National Marine Fisheries Service, Bay Saint Louis, Miss. Fisheries Engineering Lab.
INVESTIGATION USING DATA FROM ERTS TO DEVELOP AND IMPLEMENT UTILIZATION OF LIVING MARINE RESOURCES Interim Report, 1 Jul. 1972 - 10 Mar. 1973
William H. Stevenson, Principle Investigator and Edward J. Pastula, Jr. Jun. 1973 19 p ERTS
(NASA Order S-70246-AG)
(E73-10624; NASA-CR-132035) Avail: NTIS HC $3.00 CSCL 08A

The author has identified the following significant results. A feasibility study to demonstrate the potential of satellites for providing fisheries significant information was conducted in the Mississippi Sound and adjacent offshore waters. Attempts were made to relate satellite acquired imagery to selected oceanographic parameters and then to relate these parameters to aircraft remotely sensed distribution patterns of resident surface schooling fishes. Initial results suggest that this approach is valid and that the satellite acquired imagery may have important fisheries resource assessment implications.

N73-24385*# TRW Systems Group, Redondo Beach, Calif.
ERTS IMAGE DATA COMPRESSION TECHNIQUE EVALUATION Monthly Progress Report, period ending 1 Jun. 1973
Donald J. Spencer, Principal Investigator 8 Jun. 1973 2 p ERTS
(Contract NAS5-21746)
(E73-10625; NASA-CR-132036; TRW-7132.1-20) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-24386*# Grumman Ecosystems Corp., Bethpage, N.Y.
VIRGIN ISLANDS ERTS-1 EXPERIMENT NO. 589 Progress Report, Apr. - May 1973
W. C. Coulbourn, Principal Investigator 5 Jun. 1973 2 p ERTS
(Contract NAS5-21811)
(E73-10626; NASA-CR-132037) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-24387*# Geological Survey, Hartford, Conn.
ESTUARINE AND COASTAL WATER DYNAMICS CONTROLLING SEDIMENT MOVEMENT AND PLUME DEVELOPMENT IN LONG ISLAND SOUND Progress Report, 1 Mar. - 30 Apr. 1973
Frederick H. Ruggles, Jr., Principal Investigator 1 May 1973 2 p ERTS
(NASA Order S-70243-AG-3)
(E73-10627; NASA-CR-132038) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-24388*# Geological Survey, Washington, D.C.
INVESTIGATION OF ERTS-A IMAGES FOR APPLICATION TO THEMATIC MAPPING Progress Report, 1 Mar. - 30 Apr. 1973
Dean T. Edson, Principal Investigator 1 May 1973 3 p ERTS
(NASA Order S-70243-AG)
(E73-10628; NASA-CR-132039) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Composite mosaics made of open water extractions of the Mississippi River at normal stage and those derived for various flood stages illustrate with startling clarity the recent flood and provide an excellent and timely historical documentation of the temporal changes in flood extent between successive cloud-free ERTS-1 passes.

N73-24389*# Nebraska Univ., Lincoln.
PROPOSAL TO EVALUATE THE USE OF ERTS-A IMAGERY IN MAPPING AND MANAGING SOIL AND RANGE RESOURCES IN THE SAND HILLS REGION OF NEBRASKA Progress Report, 1 Mar. - 30 Apr. 1973
James V. Drew, Principal Investigator 30 Apr. 1973 6 p ERTS
(Contract NAS5-21756)
(E73-10629; NASA-CR-132040) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. There appears to be a direct relationship between densitometry values obtained with MSS band 5 imagery and forage density for those range sites measured on the imagery, provided site category identification is indicated by other forms of imagery or ground truth. Overlap of density values for different site categories with differing forage condition classes does not allow assigning

a given forage density value for a given densitometer value unless the range site category is known.

N73-24390*# Dartmouth Coll., Hanover, N.H. Dept. of Geography.
LAND USE OF NORTHERN MEGALOPOLIS FROM ERTS-1 IMAGERY Interim Report, Dec. 1972 - May 1973
Robert B. Simpson, Principal Investigator 5 Jun. 1973 5 p ERTS
(Contract NAS5-21749)
(E73-10630; NASA-CR-132041; S13-116) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. A color-coded urban-type land use map of the three northern megalopolitan states of Massachusetts, Connecticut, and Rhode Island has been completed from ERTS-1 images. A computer data bank containing 11 categories of land use for the entire area by 1/4-square-kilometer cells is 80% completed. When completed, the data bank will permit the investigation to proceed to brief analytical studies for completion of the study.

N73-24391*# Delaware Univ., Newark. Coll. of Marine Studies.
APPLICATION OF ECOLOGICAL, GEOLOGICAL AND OCEANOGRAPHIC ERTS-1 IMAGERY TO DELAWARE'S COASTAL RESOURCES PLANNING Progress Report, Apr. - Jun. 1973
V. Klemas, Principal Investigator 8 Jun. 1973 7 p ERTS
(Contract NAS5-21837)
(E73-10631; NASA-CR-132042) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Communities containing five different coastal vegetation species, developed marshlands, and fresh water impoundments have been identified in ERTS-1 images. Suspended sediment and circulation patterns in imagery from five ERTS-1 passes over Delaware Bay have been enhanced and correlated with predicted current patterns. Conclusions reached are: (1) ERTS-1 is suitable platform for observing suspended sediment patterns and water masses synoptically over large areas. (2) Suspended sediment acts as a natural tracer allowing photointerpreters to deduce gross current circulation patterns from ERTS-1 imagery. (3) Under atmospheric conditions encountered along the East Coast of the United States MSS band 5 seems to give the best representation of sediment load in upper one meter of water column. (4) In the ERTS-1 imagery the sediment patterns are delineated by three to four neighboring shades of grey. (5) Negative transparencies of the ERTS-1 images give better contrast whenever the suspended sediment tones fall within the first few steps of the grey scale. (6) Color density slicing helps delineate the suspended sediment patterns more clearly and differentiate turbidity levels.

N73-24392*# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
ERTS-A IMAGERY INTERPRETATION TECHNIQUES IN THE TENNESSEE VALLEY Progress Report, 25 Mar. - 25 May 1973
Robert E. Bodenheimer, Principal Investigator 4 Jun. 1973 2 p ERTS
(Contract NAS5-21875)
(E73-10633; NASA-CR-132092) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-24393*# Alaska Univ., Fairbanks.
IDENTIFICATION, DEFINITION AND MAPPING OF TERRESTRIAL ECOSYSTEMS IN INTERIOR ALASKA Bimonthly Progress Report
J. H. Anderson, Principal Investigator 31 May 1973 11 p ERTS
(Contract NAS5-21833)
(E73-10634; NASA-CR-132093; BMPR-5) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. A reconstituted, simulated color-infrared print, enlarged to a scale of 1:250,000, was used to make a vegetation map of a 3,110 sq km area just west of Fairbanks, Alaska. Information was traced from the print which comprised the southeastern part of ERTS-1 scene 1033-21011. A 1:1,000,000 scale color-infrared transparency of this scene, obtained from NASA, was used along side the print as an aid in recognizing colors, color intensities and blends, and mosaics of different colors. Color units on the transparency and print were identified according to vegetation types using NASA air photos, U.S. Forest Service air photos, and experience of the investigator. Five more or less pure colors were identified and associated with vegetation types. These colors were designated according to their appearances on the print: (1) orange for forest vegetation dominated by broad-leaved trees: (2) gray for forest vegetation dominated by needle-leaved trees; (3) violet for scrub vegetation; (4) light violet denoting herbaceous tundra vegetation; and (5) dull violet for muskeg vegetation. This study has shown, through close examinations of the NASA transparency, that much more detailed vegetation landscape, or ecosystem maps could be produced, if only spectral signatures could be consistently and reliably recognized and transferred to a map of suitable scale.

N73-24394*# Alaska Univ., Fairbanks.
ERTS-A DATA AS A TEACHING AND RESEARCH TOOL IN THE DEPARTMENT OF GEOLOGY Bimonthly Progress Report
Donald Grybeck, Principal Investigator 7 Jun. 1973 2 p ERTS
(Contract NAS5-21833)
(E73-10635; NASA-CR-132094; BMPR-5) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. The ERTS-1 materials continue to be used in a number of courses including Geology of Alaska, Economic Geology, and Structural Geology. In addition, specific talks about the ERTS-1 material were given at a seminar at the Geophysical Institute, to the Geology Department, to numerous individuals, and were extensively used in a popularized talk on the Geology of Alaska to the local Historical Society.

N73-24395*# Alaska Univ., Fairbanks.
COORDINATION AND ESTABLISHMENT OF CENTRALIZED FACILITIES AND SERVICES FOR THE UNIVERSITY OF ALASKA ERTS SURVEY OF THE ALASKAN ENVIRONMENT Bimonthly Progress Report
Albert E. Belon, Principal Investigator 30 May 1973 6 p ERTS
(Contract NAS5-21833)
(E73-10636; NASA-CR-132095; BMPR-5) Avail: NTIS HC $3.00 CSCL 14B

There are no author-identified significant results in this report.

N73-24396*# Alaska Univ., Fairbanks.
SURVEY OF THE SEASONAL SNOW COVER IN ALASKA Bimonthly Progress Report
Gunter Weller, Principal Investigator 31 May 1973 3 p ERTS
(Contract NAS5-21833)
(E73-10637; NASA-CR-132096; BMPR-5) Avail: NTIS HC $3.00 CSCL 08L

There are no author-identified significant results in this report.

N73-24397*# Alaska Univ., Fairbanks.
FLEASIBILITY STUDY FOR LOCATING VILLAGE SITES BY SATELLITE REMOTE SENSING TECHNIQUES Bimonthly Progress Report
John P. Cook, Principal Investigator 31 May 1973 13 p ERTS
(Contract NAS5-21833)
(E73-10638; NASA-CR-132097; BMPR-5) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-24398*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
AUTOMATIC PHOTOINTERPRETATION FOR PLANT SPECIES AND STRESS IDENTIFICATION (ERTS-A1) Progress Report
G. D. Swanlund, Principal Investigator and L. Kirvada 20 May 1973 6 p ERTS
(Contract NAS5-2186)
(E73-10639; NASA-CR-132098; PR-4) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-24399*# Tennessee Univ., Knoxville.
UTILIZATION OF ERTS DATA TO DETECT PLANT DISEASES AND NUTRIENT DEFICIENCIES, SOIL TYPES AND MOISTURE LEVELS Progress Report
W. L. Parks, Principal Investigator, J. I. Sewell, J. W. Hilty, and J. C. Rennie 12 Jun. 1973 5 p refs ERTS
(Contract NAS5-21873)
(E73-10640; NASA-CR-132099; PR-2) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. Findings demonstrate the feasibility of delineating major terrain features, land uses, and crop species through computerized analyses. Channel 6 appears to give the most information for making separations of this type. By enlarging satellite imagery and visually comparing this with high altitude aerial photographs, locating small terrain features and cropland areas on satellite imagery is greatly facilitated. Forest types are discernable on the 2402 imagery with a #25 filter: pine stands have dark tones, hardwood stands have light tones, and pine-hardwood have intermediate tones. No textural differences are evident on this type of imagery. However, on the 2424 imagery with #898 filter, textural differences are evident but tonal differences are absent. Areas of considerable texture are interpreted as stands of high volume while areas of suppressed texture are of low volume. The 2402 imagery with a #57 filter appears to have little information of importance in timber inventory.

N73-24400# Instituto Geografico y Catastral, Madrid (Spain).
ANNUALS OF THE GEOMAGNETIC AND AERONOMY SERVICES FOR 1970 [ANUARIOS DEL SERVICIO DE GEOMAGNETISMO Y AERONOMIA: ANO 1970]
1972 239 p In SPANISH
Avail: NTIS HC $14.00

The annual reports of the geomagnetic measurements for 1970 at several observatories in Spain are presented. For individual titles, see N73-24401 through N73-24405.

N73-24401 Instituto Geografico y Catastral, Madrid (Spain).
ANNUAL OF THE GEOPHYSICAL OBSERVATORY ALFANSO REY PASTOR, TOLEDO FOR 1970: GEOMAGNETISM [ANUARIO DEL OBSERVATORIO CENTRAL GEOFISICO ALFONSO REY PASTOR, TOLEDO, ANO 1970: GEOMAGNETISMO]
In its Ann. of the Geomagnetic and Aeronomy Services for 1970 1972 p 1-51 In SPANISH (For availability see N73-24400 15-13)

The results deduced from the systematic measurements of the magnetic elements and continuous logs during 1970 are presented for the components of the terrestrial magnetic field at Toledo. Graphs of diurnal variations in the components of the magnetic field, which include the activity indices of the magnetic field K + C are included. Transl. by F.O.S.

N73-24402 Instituto Geografico y Catastral, Madrid (Spain).
ANNUAL OF THE ALMERIA GEOPHYSICAL OBSERVATORY FOR 1970: GEOMAGNETISM [ANUARIO DEL OBSERVATIO GEOFISICO DE ALMERIA, ANO 1970: GEOMAGNETISMO]
In its Ann. of the Geomagnetic and Aeronomy Services for 1970 1972 p 53-96 In SPANISH (For availability see N73-24400 15-13)

Geomagnetic data for 1970 at Almeria are reported. Magnetic elements presented include: horizontal intensity, declination, vertical intensity, and diurnal variations. Transl. by F.O.S.

N73-24403 Instituto Geografico y Catastral, Madrid (Spain).
ANNUAL OF THE LOGRONO GEOPHYSICAL OBSERVATORY FOR 1970: GEOMAGNETISM [ANUARIO DEL OBSERVATIO GEOFISICO DE ALMERIA, ANO 1970: GOEMAGNETISMO]
In its Ann. of the Geomagnetic and Aeronomy Services for 1970 1972 p 97-134 In SPANISH (For availability see N73-24400 15-13)

The absolute values for the hourly, daily, monthly, and annual measurements of the geomagnetic components H, D, and Z are reported along with the geomagnetic activity for 1970. Graphs of diurnal variations are included. Transl. by F.O.S.

N73-24404 Instituto Geografico y Catastral, Madrid (Spain).
ANNUAL OF THE GEOPHYSICAL OBSERVATORY, SANTA CRUZ, TENERIFE, 1970: GEOMAGNETISM [ANUARIO DEL OBSERVATORIO GEOFISICO DE SANTO CRUZ DE TENERIFE, ANO 1970: GEOMAGNETISMO]
In its Ann. of the Geomagnetic and Aeronomy Services for 1970 1972 p 135-177 In SPANISH (For availability see N73-24400 15-13)

The results of geomagnetic observations and calculations during 1970 are reported. Tables of the hourly measurements of the three magnetic elements are included. The variometer constants, and procedures for minimizing the temperature effects are described. Transl. by F.O.S.

N73-24405 Instituto Geografico y Catastral, Madrid (Spain).
ANNUAL OF THE GEOPHYSICAL OBSERVATORY, MOCA (FERNANDO POO) FOR 1970: GEOMAGNETISM AND METEOROLOGY [ANUARIO DEL OBSERVATORIO GEOFISICO MOCA (FERNADO POO) ANO 1970: GEOMAGNETISMO Y METEOROLOGIA]
In its Ann. of the Geomagnetic and Aeronomy Services for 1970 1972 p 179-247 In SPANISH (For availability see N73-24400 15-13)

The results of geomagnetic observations and calculations at Moca for 1970 are presented. The data reported include: declination, horizontal intensity, vertical intensity, and rapid variations. Tabulated meteorological observations are also included. Transl. by F.O.S.

N73-24406# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 31, FEBRUARY 1973 IONOSPHAEREN-DATEN VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE 31, FEBRUAR 1973]
Feb. 1973 44 p ref In GERMAN and FRENCH
(Rept-320-F) Avail: NTIS HC $4.25

Daily summaries are presented for vertical echo sounding of the upper atmosphere during February 1973. The data include charts of median values for the E and F regions. Author

N73-24407# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, JULY 1972
1972 347 p refs
Avail: NTIS HC $19.50

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocket sonde data. Author

N73-24408*# Alaska Univ., Fairbanks. Geophysical Inst.
THE HYDROXYL EMISSIONS IN RELATION TO THE DYNAMICAL PROCESSES OF THE ATMOSPHERE Final Report, 1 Feb. 1970 - 31 Dec. 1972
Gerald J. Romick Jan. 1973 11 p refs
(Grant NGR-02-001-066)
(NASA-CR-130237) Avail: NTIS HC $3.00 CSCL 04B

Ground and airborne hydroxyl emission observations were made in the northern polar regions. The ground observations were made at Ester Dome, Alaska, and the airborne observations were made during the 1969 NASA Airborne Expedition. The analysis of some of the data that were acquired has lead to the following conclusions: (1) Airglow OH measurements show no appreciable change with latitude or longitude. (2) Diurnal changes at northern latitudes are similar to those observed in midlatitude regions. (3) Two types of OH enhancements were observed photometrically in the 9370 A region - one associated with visible aurora, and the other uncorrelated with visible aurora. High resolution spectra under both inactive and active conditions indicate that the OH enhancements seen photometrically in active aurorae are probably due to contamination of the filter pass bands by the unexpected enhancement of the NI multiplet lines at 9387 A and 9393 A. All previously reported aurorally associated enhancements are consequently suspect. Author

N73-24409*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
ANALYSIS OF DATA OF THE 1968-1969 AIRBORNE

AURORAL EXPEDITIONS Final Report
S. B. Mende Mar. 1973 63 p refs
(Contract NAS2-7296)
(NASA-CR-114616) Avail: NTIS HC $5.25 CSCL 04A

Data collected by the CV-990 aircraft on two auroral expeditions are reported. Two problems, (1) coordinated auroral particle and optical observations, and (2) substorm effects in auroral spectra, were studied. Author

N73-24410*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
UNSUPERVISED SPATIAL CLUSTERING WITH SPECTRAL DISCRIMINATION
Robert R. Jayroe, Jr. Washington May 1973 91 p refs
(NASA-TN-D-7312; M-107) Avail: NTIS HC $3.00 CSCL 05B

The development of a computer program is reported for extracting features from remotely sensed data presented in digital image form. This computer program requires no human supervision or prejudgment and operates unassisted on the raw digital data. A condensed general background is included on remote sensing of earth features and a short synopsis on some of the most commonly used types of feature extraction techniques. Results obtained from the unsupervised feature extraction computer program along with a description and listing of the computer program are presented. Author

N73-24411*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
IDENTIFICATION AND MAPPING OF SOILS, VEGETATION, AND WATER RESOURCES OF LYNN COUNTY, TEXAS BY COMPUTER ANALYSIS OF ERTS MSS DATA
Marion F. Baumgardner, Steven J. Kristof, and James A. Henderson, Jr. 1973 11 p
(Grant NGL-15-005-112)
(NASA-CR-132956; LARS-030373) Avail: NTIS HC $3.00 CSCL 08H

The results of the analysis and interpretation of ERTS multispectral data obtained over Lynn County, Texas are presented. The test site was chosen because it enbodies a variety of problems associated with the development and management of agricultural resources in the Southern Great Plains. The utility of ERTS data in identifying, characterizing and mapping soils, vegetation, and water resources in this semiarid region is examined. Preliminary results from this study suggest that ERTS data may be used successfully in semiarid regions to accomplish the above tasks. Author

N73-24412*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THREE-D MULTILATERATION: A PRECISION GEODETIC MEASUREMENT SYSTEM
P. R. Escobal, K. M. Ong, O. H. VonRoos, M. S. Shumate, R. M. Jaffe, H. F. Fliegel, and P. M. Muller 15 Mar. 1973 316 p refs
(Contract NAS7-100)
(NASA-CR-132251; JPL-TM-33-605) Avail: NTIS HC $18.00 CSCL 08E

A technique of satellite geodesy for determining the relative three dimensional coordinates of ground stations within one centimeter over baselines of 20 to 10,000 kilometers is discussed. The system is referred to as 3-D Multilateration and has applications in earthquake hazard assessment, precision surveying, plate tectonics, and orbital mechanics. The accuracy is obtained by using pulsed lasers to obtain simultaneous slant ranges between several ground stations and a moving retroreflector with known trajectory for aiming the lasers. Author

N73-24413*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A DETAILED GRAVIMETRIC GEOID OF NORTH AMERICA, EURASIA, AND AUSTRALIA
Samir Vincent (Computer Sciences Corp.) and William E. Strange (Computer Sciences Corp.) Sep. 1972 53 p refs Presented at the Intern. Symp. on Earth Gravity Models and Related Probl., Saint Louis, 16-18 Aug. 1972
(NASA-TM-X-66238; X-553-72-331) Avail: NTIS HC $4.75 CSCL 08E

A detailed gravimetric geoid of North America, the North Atlantic, Eurasia, and Australia computed from a combination of satellite-derived and surface 1 x 1 gravity data, is presented. Using a consistent set of parameters, this geoid is referenced to an absolute datum. The precision of this detailed geoid is + or - 2 meters in the continents but may be in the range of 5 to 7 meters in those areas where data was sparse. Comparisons of the detailed gravimetric geoid with results of Rice for the United States, Bomford and Fischer in Eurasia, and Mather in Australia are presented. Comparisons are also presented with geoid heights from satellite solutions for geocentric station coordinates in North America, the Caribbean, Europe, and Australia. Author

N73-24414*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WHISTLER WAVES OBSERVED UPSTREAM FROM COLLISIONLESS SHOCKS
D. H. Fairfield May 1973 61 p refs Submitted for publication
(NASA-TM-X-66245; X-692-73-129) Avail: NTIS HC $5.25 CSCL 04A

Waves in the frequency range 0.5 - 4 Hz were studied in the region upstream of the earth's bow shock using data from the fluxgate magnetic field experiment on IMP-6. Analysis of 150 examples of these waves during a three month interval indicates that amplitudes are generally less than 1 or 2 gammas and propagation directions generally make angles of between 20 and 40 degrees with the field direction. The waves as measured in the spacecraft frame of reference are either left or right hand polarized with respect to the average field direction. It is concluded that the observed waves are right handed waves in the plasma frame of reference with wavelengths of approximately 100 km propagating upstream in the whistler mode. Doppler shifting reduces the observed frequencies in the spacecraft frame and reverses the observed polarization for those waves propagating more directly upstream. Similar waves are seen ahead of most interplanetary shocks. Author

N73-24415*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELEVENTH ORDER RESONANCE TERMS IN THE GEOPOTENTIAL FROM THE ORBIT OF VANGUARD 3
C. A. Wagner May 1973 32 p refs Submitted for publication
(NASA-TM-X-66246; X-592-73-130) Avail: NTIS HC $3.75 CSCL 03B

The orbit of Vanguard 3 (1959-7A) is strongly resonant with 11th order and odd degree terms in the geopotential. It affords an excellent opportunity to determine a significant linear constraint between these terms. Tracking data on this satellite (in the form of mean Kepler elements) are analyzed over a 3 1/2 year period in the early 1960's, which ends with the orbit having just passed through perfect commensurability. The eccentricity and inclination show the deep resonance variations (up to 0.0002 in e and .02 deg in i) with great clarity. Previous and current geopotential solutions fail to explain these perturbations. Author

N73-24416*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A REPRESENTATION OF JACCHIA'S THERMOSPHERIC MODELS IN SPHERICAL HARMONICS
P. Blum and I. Harris May 1973 17 p refs Submitted for Publication
(NASA-TM-X-66247; X-621-73-133) Avail: NTIS HC $3.00 CSCL 04A

The Jacchia models are represented in terms of spherical harmonic functions. This representation has the advantages of ease of comparison with theoretical and other observational models and data, mathematical analyticity and relative simplicity. The symmetry properties of the models are emphasized by this representation and some physical characteristics like the increase of the amplitude of the diurnal density variation with decreasing solar activity become more apparent. Author

N73-24417# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
THE IMPLEMENTATION OF THE PARTIAL REFLECTION EXPERIMENT AT THE SCOTIA FACILITY
John Joseph Portelli 26 Apr. 1973 70 p refs
(Contract N00014-67-A-0385-0014; Grant NSF GA-1385)

(PSU-IRL-SCI-414) Avail: NTIS HC $5.50
The design and construction of an experimental system for receiving and recording echoes from the D-region of the ionosphere is described. A brief presentation of the theory of partially reflected echoes is included with emphasis on some of the more recent theoretical developments. Since partially reflected echoes are weak ecohes, a sensitive receiving and recording system is neccessary. Therefore, modifications were made to an existing antenna structure to permit duplex operation with this antenna. These modifications are discussed in detail. Because it was desired to have data recorded in an automatic fashion, an automated data recording system was developed. The report presents the design, construction, and testing of the automatic recording system which will ultimately be used with a digital recording system now under construction. All circuit diagrams are included along with any other information which may be helpful in equipment operation and repair. A brief description of some of the recorded data is presented. Author

N73-24418# New Hampshire Univ., Durham. Space Science Center.
ELECTRON ACCELERATION DURING TAIL COLLAPSE
Richard L. Kaufmann May 1973 23 p refs
(Grant NSF GA-32501X)
(UNH-73-04) Avail: NTIS HC $3.25
Calculations are made to determine what changes are expected in the energy spectra and pitch angle distributions of electrons that are seen during substorms. The calculations begin with an isotropic Maxwell-Boltzmann distribution, and assume that the electrons move toward the earth while conserving the first two adiabatic invariants. A model for plasma and field-line motion is chosen to approximate motions that have been observed in the tail during substorms. The calculated energy changes apply to almost any inward plasma motion. The energy distribution remains Maxwellian, and both the energy of an individual electron and the Maxwell-Boltzmann characteristic energy increase by the same ratio as electrons move to lower field lines. The pitch angle changes depend more sensitively on details of the model than do energy changes. There is a general tendency for electron fluxes to become peaked at 90 deg if the first two invariants are conserved during acceleration. Author

N73-24419# Lockheed Missiles and Space Co., Palo Alto, Calif.
DIRECT MEASUREMENTS OF THE ELECTRICAL CONDUCTIVITY AND RELAXATION TIME OF IONIZED AIR IN THE STRATOSPHERE AND MESOSPHERE
Iu. A. Bragin, A. A. Kocheev, and O. A. Bragin [1973] 7 p refs Transl. into ENGLISH from Kosmich. Issled. (USSR), v. 11, no. 1, 1973 p 124-129
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616
Continuous altitude profiles of air conductivity in the stratosphere and mesosphere are presented. Direct measurements of the conductivity were made by an open dissipating body. The results are compared with theoretical computations. Author

N73-24420# Lockheed Missiles and Space Co., Palo Alto, Calif.
ABSORPTION OF HYDROMAGNETIC WAVES IN THE PLASMA LAYER OF THE MAGNETOSPHERE TAIL
A. S. Potapov [1973] 4 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 13, no. 2, 1973 p 377-379
Avail: NTIS HC $3.00, National Translations Center, John Crerar Library, Chicago, Ill. 60616
A simplified geomagnetic tail model in the form of a system of plane parallel layers is formulated and used to analyze hydromagnetic oscillations in the magnetospheric tail. The dissipation associated with the collisionless hydromagnetic wave damping is estimated and the plasma is considered a thermalized solar wind. The lines of force of the magnetic field are assumed to be parallel to each other and the layer boundaries. It is shown that the most extensive hydromagnetic waves are excited in the tail during a substorm and that absorption of these waves is one of the mechanisms of plasma layer heating. G.G.

N73-24421# Lockheed Missiles and Space Co., Palo Alto, Calif.
ROCKET MEASUREMENTS OF THE IONIC COMPOSITION
A. D. Zhludko [1973] 11 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 11, no. 2, 1973 p 297-305
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616
Rocket mass spectrometer measurements are presented on the ionic composition of the atmosphere at 100 - 270 km altitudes in the middle latitudes and measurements of the ions in the 100 - 170 km altitude range in the polar regions. Experiments to study the effect of ionization of water vapor H2O and D2O by atmospheric agents were conducted during the mass spectrometer measurements in the ionosphere. It has been established that 18+ (H2O +) and 19+ (H2O +) positive ions are formed in the ionization of water vapor H2O, and the ions 20+ (D2O +), 21+ (HD2O +) and 22+ (D3O +) appear in the ionization of D2O. The time history of the process of moisture desorption from the rocket surface was determined from the data obtained. Intensive ionization of the water vapors was observed at the altitudes of the F region of the ionosphere both by day and by night. Author

N73-24422# Lockheed Missiles and Space Co., Palo Alto, Calif.
SOME RESULTS OF MEASURING THE INHOMOGENEITY PARAMETERS OF THE IONOSPHERE ELECTRON CONCENTRATION ON THE KOSMOS-381
G. G. Getmantsev, G. P. Komrakov, V. P. Ivanov, I. V. Popkov, and V. N. Tiukin [1973] 3 p refs Transl. into ENGLISH from Kosmich. Issled. (USSR), v. 11, no. 2, 1973
HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616
The electron concentration in the ionosphere was determined by measuring the magnitude of the change in transducer capacitance as function of change in ionospheric dielectric constant. The high frequency impedance probe was mounted on the Cosmos 381 satellite. G.G.

N73-24423# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE NEUTRAL HYDROGEN DISTRIBUTION IN THE EARTH'S UPPER ATMOSPHERE
S. D. Chuvakhin [1973] 3 p refs Transl. into ENGLISH from Kosmich. Issled. (USSR), v. 11, no. 2, 1973 p 338-340
HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616
Results of the Cosmos 215 satellite investigation are used to construct four models of the neutral hydrogen distribution in the base of the exosphere. These models show that the intensity of scattered radiation in the geocorona at an altitude of 360 km is a function of the sun's zenith distance. J.M.M.

N73-24424# Oregon State Univ., Corvallis.
MULTISPECTRAL SCANNER STUDIES OF THE OCEAN OFF THE OREGON COAST
[1973] 67 p refs
Avail: NTIS HC $5.50
Analysis of multispectral scanner data from flight lines off the Oregon coast during the summer of 1969 revealed changes in radiance of backscattered light that were related to upwelling, the Columbia River plume, and oceanic water. Cold, upwelled water was usually green, presumably because of high phytoplankton concentrations. Differences between blue and green radiances (channels 2 and 4) were small (0.1 or less) and between 4 and 6 (green and orange-red) were large. Upwelled water was also spectrally variable probably because of the biological changes that occur during the aging and offshore advection of this water. Author

N73-24425*# Scripta Technica, Inc., Washington, D.C.
PARTIAL EFFECTS OF THE PENETRATION OF MONOENERGETIC AND UNIDIRECTIONAL PROTON BEAMS INTO THE UPPER POLAR ATMOSPHERE (PROTON AURORA)
Yu. N. Ponomarev NASA Jun. 1973 14 p refs Transl. into ENGLISH of "Partsialye Effekty Vtorzheniya v Polyarnuyu Verkhnyuyu Atmosferu Monoenergeticheskikh i Mononapravlennykh Puchkov Protonov (Protonnye Polyarnie siyaniya)" Acad. of Sci., USSR, Inst. for Space Res., Moscow, report Pr-116, 1972 16 p
(Contract NASw-2484)
(NASA-TT-F-14802; Pr-116) Avail: NTIS HC $3.00 CSCL 04A
Calculations are described which demonstrate that proton

scattering occurs upon penetration into atmosphere at heights above 200 km, and that the luminosity of the hydrogen emission spectra is penetrated below this level. Author

N73-24426*# Linguistic Systems, Inc., Cambridge, Mass.
THE ISOTOPE COMPOSITION OF THE CARBON IN CARBONACEOUS ROCKS FROM THE OIL FIELD OF BELORUSSIA AS AN INDICATION OF THEIR ORIGIN
G. A. Kazenkina Washington NASA Jun. 1973 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk (BSSR), v. 16, 1972 p 545-548
(Contract NASw-2482)
(NASA-TT-F-14938) Avail: NTIS HC $3.00 CSCL 08G

The diagenetic transformations yielding the upper Devonian intersalt deposits of the Rechitska and Ostashkovich regions are considered in terms of their carbon isotope composition. The local organogenic carbon cycle is explained. The physio-chemical conditions of formation, depending on states of oxidation or reduction during deposition, were shown to have sharp fluctuations. While development of karst did not occur, the sequence of diagenetic transformations was disturbed by brief local interruptions. Indications are that the mineral forming processes took place before the collectors were filled with oil and during its entry into the collectors. Author

N73-24427*# Kanner (Leo) Associates, Redwood City, Calif.
COSMOS-243 MICROWAVE MEASUREMENTS OVER GREENLAND ICE
A. A. Kurskaya et al Washington NASA Jun. 1973 7 p refs Transl. into ENGLISH from a Preprint of the USSR Academy of Science (Moscow), 1970 9 p
(Contract NASw-2481)
(NASA-TT-F-14953) Avail: NTIS HC $3.00 CSCL 08L

Some experimental data on the characteristics of thermal radiation of ice regions in the northern hemisphere produced by the Cosmos-243 over the territory of Greenland are studied. The measurements performed allowed estimation of the temperature mode and variations in radiating capacity of the surface, and determination of the borders of the ice fields at the shore of Greenland up to 71 N. Author

N73-24428*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VLF-HISS FROM ELECTRONS IN THE EARTH'S MAGNETOSPHERE
Kaichi Maeda May 1973 89 p refs Submitted for publication
(NASA-TM-X-66255; X-646-73-111) Avail: NTIS HC $6.50 CSCL 03B

Intensities of auroral and magnetospheric hiss generated by the Cherenkov radiation process of electrons in the lower magnetosphere were calculated with respect to a realistic model of the earth's magnetosphere. In this calculation, the magnetic field was expressed by the Mead-Fairfield Model, and a static model of the iono-magnetospheric plasma distribution was constructed by accumulated data obtained by recent satellite observations. The energy range of hiss producing electrons and the frequency range of produced VLF in the computation are 100 eV to 200 keV, and 2 to 200 kHz, respectively. The maximum hiss intensity produced by soft electrons is more than one order higher than that of hard electron produced hiss. Higher rate of hiss occurrence in the daytime side, particularly in the soft electron precipitation zone in the morning sector, and less association of auroral hiss in night time sectors must be, therefore, due to the local time dependence of the energy spectra of precipitating electrons rather than the difference in the geomagnetic field and in the geoplasma distributions. Author

N73-24429# National Ocean Survey, Rockville, Md.
PACIFIC SEAMAP 1961 - 1970 DATA FOR AREA 15248-14, LONGITUDE 152 DEG W TO 166 DEG W, LATITUDE 48 DEG N TO 54 DEG N, BATHYMETRY, MAGNETICS, AND GRAVITY
J. J. Dowling (Conn. Univ.), E. F. Chiburis (Conn. Univ.), P. Dehlinger (Conn. Univ.), and M. J. Yellin Apr. 1972 414 p refs
(NOAA-TR-NOS-47) Avail: SOD $3.50

Processed bathymetry, magnetic, and gravity data, collect between 1961 and 1967 in the North Pacific area bound by longitudes 152 W and 166 W and latitudes 48 N and 54 N (SEAMAP Area 15248-14), and some data collected north of 54 N in SEAMAP Area 15254-14, are listed in computer printout format. More than 20,000 evaluated data points from Project Pacific SEAMAP surveys are included. Pacific SEAMAP survey were initiated in 1961 by the coast and geodetic survey and continued after July 1965 by the C and GS of the Environmental Science Services Administration and after October 1970 by the National Ocean Survey of the National Oceanic and Atmospheric Administration. The listing identifies the vessel, cruise, position and time of each bathymetric measurement, corrected depth, correction applied for sound velocity variation, total magnetic field intensity, magnetic anomaly, observed gravity, free-air gravity anomaly, and gravity meter used. Author

N73-24430# Lockheed Missiles and Space Co., Palo Alto, Calif.
DIRECT MEASUREMENTS OF PLASMA CONVECTION IN THE UPPER IONSPHERE
Iu. I. Galperin and V. N. Ponomarev [1973] 8 p refs Transl. into ENGLISH from Kosmich. Issled (Moscow), v. 11, no. 1, 1973 p 88-94
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Results are presented of direct measurements of the convection velocities in the horizontal plane for near polar and polar upper ionospheres at an altitude of 630 km. These velocities were measured by the Cosmos 184 Satellite during a moderate magnetic disturbance on 4 November 1967. A special differential ion sensor oriented relative to the satellite velocity vector was used to measure the magnitude of the free ion stream. The data obtained agree with those resulting from convection measurements made from the drift of barium clouds. Author

N73-24431*# Barringer Research Ltd., Rexdale (Ontario).
FEASIBILITY STUDY OF THE APPLICATION OF EXISTING TECHNIQUES TO REMOTELY MONITOR HYDROCHLORIC ACID IN THE ATMOSPHERE
H. Zwick, V. Ward, and L. Beaudette Apr. 1973 71 p refs
(Contract NAS1-11923)
(NASA-CR-112274; TR-73-226A) Avail: NTIS HC $5.75 CSCL 04A

A critical evaluation of existing optical remote sensors for HCl vapor detection in solid propellant rocket plumes is presented. The P branch of the fundamental vibration-rotation band was selected as the most promising spectral feature to sense. A computation of transmittance for HCl vapor, an estimation of interferent spectra, the application of these spectra to computer modelled remote sensors, and a trade-off study for instrument recommendation are also included. Author

N73-24432# Bureau of Mines, Denver, Colo.
SATELLITE MONITORING OF OPEN PIT MINING OPERATIONS
William C. Henkes 1971 32 p
(BM-IC-8530) Avail: SOD $0.35

The relationships between areal extent, development, volume of waste dumps, and the pits of open pit mining operations as observed on the ground and on photographs taken from satellites are investigated. The ultimate goal is the establishment of criteria to evaluate repetitive space imagery in quantifiable terms. These criteria would aid the Bureau of Mines in discharging its responsibilities in the fields of solid waste disposal, reclamation of mine workings, and mineral resources inventory. The study serves as a basis for additional experiments using remote sensing techniques in the minerals industry. Author

N73-24433*# Colorado School of Mines, Golden. Dept. of Geology.
APPLICATION OF REMOTE SENSOR DATA TO GEOLOGIC ANALYSIS OF THE BONANZA TEST SITE COLORADO Semiannual Progress Report, 1 Oct. 1972 - 31 Mar. 1973
Keenan Lee, comp. Apr. 1973 55 p refs
(Grant NGL-06-001-015)
(NASA-CR-132231; Rept-73-2) Avail: NTIS HC $4.75 CSCL 08G

A geologic map of the Bonanza Test Site is nearing completion. Using published large scale geologic maps from various sources, the geology of the area is being compiled on a

base scaled at 1:250,000. Sources of previously published geologic mapping include: (1) USGS Bulletins; (2) professional papers and geologic quadrangle maps; (3) Bureau of Mines reports; (4) Colorado School of Mines quarterlies; and (5) Rocky Mountain Association of Geologist Guidebooks. This compilation will be used to evaluate ERTS, Skylab, and remote sensing underflight data. Author

N73-24434# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
TOTAL MODELLING OF GRAVITATIONAL FIELDS INTO A PLANE SPACE WITH SYMMETRY CONSERVATION
M. E. Sinovskii 1972 32 p refs In RUSSIAN; ENGLISH summary
(ITF-72-139-P) Avail: AEC Depository Libraries

The idea of symmetry conservation under modelling amplifies A.Z. Petrov's idea of gravitational field modeling. The modeling of general gravitational fields and Einstein spaces into a plane space with symmetry conservation is considered in detail. Author (NSA)

N73-24435# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
CHARACTERISTICS OF THE GENERAL CIRCULATION OF THE ATMOSPHERE AND THE GLOBAL DISTRIBUTION OF TOTAL OZONE AS DETERMINED BY THE NIMBUS 3 SATELLITE INFRARED INTERFEROMETER SPECTROMETER Atmospheric Science Paper no. 180
J. E. Lovill Feb. 1972 83 p refs
(Contract AT(11-1)-1340)
(COO-1340-30) Avail: NTIS

Analysis of Nimbus 3 global ozone measurements show a strong correlation between the meridional gradient of total ozone and the wind velocity in jet stream systems. Time longitude variations of the total ozone for several latitudes in the Northern and Southern Hemispheres for June 1969 show that the speed at which ozone waves progress eastward is greater in the winter hemisphere with progression rates as high as fifteen degrees of longitude per day. Closely spaced total ozone isolines for the Northern and Southern Hemispheres reveal a reasonably strong jet stream west of South America at approximately 35 S. Both the Northern and the Southern Hemispheres appear to provide anchoring mechanisms for total ozone ridges, with the tightest gradient of total ozone seen in either hemisphere located over Japan. Author

N73-24436# Alaska Univ., College. Geophysical Inst.
EARTH TILTS IN CONNECTION WITH CRUSTAL FAILURE: A STUDY IN ALASKA Annual Progress Report
H. Pulpan Dec. 1972 42 p refs
(Contract AT(45-1)-2229)
(RLO-2229-T-4-2) Avail: NTIS

Tilt steps associated with local, regional, and distant earthquakes were observed with tiltmeters in Central Alaska. Observed tilt steps cover a distance range from a few to over 12,000 km and a magnitude range from 1.4 to 8. Tilt step propagation velocities were observed from 1.6 to 3.6 km/sec. Tilt amplitudes are generally much higher than those expected for the static deformation field. It has not been resolved whether these tilt steps are truly source-associated or secondary effects. Long term tilts show several accelerations of the secular tilt rate, probably indicating the occurrence of aseismic strain release. Investigation into tidal tilts reveals a strong influence of the ocean tides in the Gulf of Alaska upon the earth tides. Author

N73-24437# Institute of Mathematical Science, Madras (India).
LECTURE NOTES ON GRAVITATIONAL COLLAPSE AND GRAVITATIONAL RADIATION
A. R. Prasanna [1972] 73 p refs
(MATSCIENCE-72) Avail: AEC Depository Libraries

Starting with a study of the Schwarzschild singularity, the gravitational implosion problem was studied through various solutions. In this context the problems associated with boundary conditions in general relativity and with singularities are considered. The quadrupole nature of gravitational radiation is established and some exact solutions representing gravitational radiation fields are presented. NSA

N73-24438# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Oct. 1972 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE BULLETIN MENSUEL, OCTOBER 1972]
Oct. 1972 31 p In FRENCH and DUTCH
Avail: NTIS HC $3.75

Results of ionospheric and cosmic ray (neutron component) observations at Dourbes, Belgium are tabulated for October 1972. ESRO

N73-24439# Institut Franco-Allemand de Recherches, St. Louis (France).
MEASUREMENTS OF MESOSPHERIC LIGHT, PART 1 [LICHTMESSUNGEN IN DER MESOSPHAERE, 1. TEIL]
F. Roessler and D. Bock 25 Jul. 1972 43 p refs In GERMAN
(Contract T/0260/12630/11013)
(ISL-16/72-Pt-1) Avail: NTIS HC $4.25

In order to investigate the atmospheric layers generated by aerosols and measure the diffuse skylight in the earth atmosphere, some Centaure sounding rockets were launched from Kiruna during August 1969 and in 1970. Results of the campaign performed in August 1961 are reported. It is shown that, in spite of the absence of noctilucent clouds in 1969, the variations of recorded light indicate the presence of a very weak layer at an 82 km altitude, and therefore it was concluded to be a permanent layer formation. ESRO

N73-24440# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany). Inst. fuer Extraterrestrische Physik.
PHOTO-IONIZATION CROSS SECTION MEASUREMENT OF BARIUM 1 AND STRONTIUM 1 IN THE WAVELENGTH REGION BETWEEN 1700 AND 2400 A [MESSUNG DES PHOTOIONISATIONSQUERSCHNITTS VON BA 1 UND Sr 1 IM WELLENLAENGENBEREICH 1700 - 2400 A]
Peter Luetjens Nov. 1972 54 p refs In GERMAN
(MPI-PAE/Extraterr-75) Avail: NTIS HC $4.75

The photoionization cross sections of barium and strontium were determined experimentally. Measurements were made using an atomic beam crossed by an ultraviolet light beam and by absolute measurement of the three independent parameters: atomic number density, UV intensity, and ion current. The density is determined by measuring the equivalent width of optically thick absorption lines of the evaporated elements. Absolute intensity of the ultraviolet beam is measured with a calibrated fluorescence detector. The detection of produced ions takes place by modulation of the photoionizing UV light. An instrumental bandwidth of 20 Angstroms is not sufficient for spectral resolution of all autoionization lines, but a comparison with known absorption spectra is possible by convolution calculation. ESRO

N73-24441# Banaras Hindu Univ., Varanasi (India). Inst. of Technology.
NATURAL GENERATION OF ELECTROMAGNETIC WAVES AND INTERACTIONS WITH MEDIA Final Report, 1 Sep. 1969 - 31 Aug. 1972
R. N. Singh Oct. 1972 210 p refs
(Grant EOOAR-0070-70; AF Proj. 5631)
(AD-757901; AFCRL-TR-73-0093) Avail: NTIS CSCL 04/1

The report describes in detail the electrical conductivity of the plasma, the effects of collisions, of static electric and magnetic fields, effects of plasma perturbations, the derivation of plasma conductivity from the Boltzmann equation, and non-linear aspects of plasma conductivity. In subsequent sections, the electromagnetic wave radiations from accelerated electrons are classified into four main processes such as cyclotron- and Doppler-shifted cyclotron radiation, Cerenkov and synchrotron radiation and compared with each other. The wave generation by the Cerenkov process, atmospheric Bremsstrahlung, Plasma oscillation, Ion acoustic waves, wave particle resonance and energization of charged particles are treated. Further work examines the heating of the electron gas by electric and magnetic fields, the role of pitch angle distribution in the heating mechanism and the heating of a magnetoplasma by oscillating fields. A section is devoted to the probing of inhomogeneous plasma by electromagnetic pulses and the propagation of a Gaussian pulse through a plasma. The final section deals with antennas in weakly ionized plasma, the effects of plasma scattering on transmission range

from satellites and the radiation from conical helix antennas aiding data transmission. Author (GRA)

N73-24442# Cornell Univ., Ithaca, N.Y. Lab. of Plasma Studies.
LABORATORY SIMULATION OF ARTIFICAL PLASMA CLOUDS IN THE IONOSPHERE
David L. Morse and William W. Destler Mar. 1973 42 p refs
(Contract N00014-67-A-0077-0002)
(AD-758064; LPS-114) Avail: NTIS CSCL 04/1

The results of an experiment to model the behavior of artificial plasma clouds in the ionosphere are presented. The formation of field-aligned structure or striations is frequently observed. The appearance of this structure and its subsequent motion are found to be in substantial agreement with theory. In particular, the ratio of the integrated Pedersen conductivity of the cloud to that of the background through which it moves is found to be an important factor determining the growth rate of the striations. Author (GRA)

N73-24443# Meteorology International, Inc., Monterey, Calif.
THE DEVELOPMENT OF TECHNIQUES FOR OPERATIONAL EXPLOITATION OF SATELLITE INFRARED CHANNEL RADIANCES IN THE RESOLUTION OF ATMOSPHERIC THERMAL STRUCTURE VARIABILITIES. TASK TWO: NEW FORMULATIONS
Manfred M. Holl Mar. 1973 95 p
(Contract N62306-72-C-0125)
(AD-757773; M-181) Avail: NTIS CSCL 04/1

The authors develop techniques for operational exploitation of satellite infrared channel radiances in the resolution of atmospheric thermal-structure variabilities. The purpose is to develop capabilities for assimilating all available relevant information for operational synoptic resolution of the significant variabilities of the atmospheric thermal-structure distribution. In particular, it is hoped to be able to exploit the information in satellite infrared channel radiance measurements. This is done by expanding analysis concepts which already provide broad capabilities for assimilating information. GRA

N73-24444# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THE AEROSPACE CORPORATION SPACE SCIENCE PROGRAM REPORT TO COSPAR, CY 72 Technical Report, Jan. - Dec. 1972
George A. Paulikas, comp. 30 Jan. 1973 18 p refs
(Contract F04701-72-C-0073)
(AD-757874; TR-0073(3260-01)-2; SAMSO-TR-73-102) Avail: NTIS CSCL 04/1

The Laboratories of The Aerospace Corporation are carrying out a research program in the space sciences consisting of both satellite based and ground based observations. This report summarizes the results obtained in CY 1972. Research efforts during the past year concentrated on the physics of the earth's upper atmosphere, solar-terrestrial interactions, magnetospheric physics and solar physics. GRA

N73-24445# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
TRANSPORT MEASUREMENTS IN THE STRATOSPHERE Interim Report
Norman W. Rosenberg, Robert E. Good, and Samuel P. Simmerman 11 Jan. 1973 17 p refs Presented at Conf. on the Climatic Impact Assessment Program (2d), Cambridge, Mass., 14-17 Nov. 1972; sponsored by DOT
(AD-757927; AFCRL-TR-73-0021) Avail: NTIS CSCL 04/1

The objective of the study is to determine the atmospheric transport processes in the 15-30 km altitude region where SST emission products are deposited. The experiments are designed to provide simultaneous measurements of temperature, wind velocities and ozone concentration. The eddy diffusion coefficient will be estimated independently from wind shear fluctuations, photographic trail image density fluctuations, and temperature fluctuations. (Author Modified Abstract) GRA

N73-24446# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
LOW ENERGY PARTICLE EXPERIMENT Annual Technical Report, 1 Apr. 1972 - 31 Mar. 1973
Edward G. Shelley 23 Mar. 1973 15 p refs
(Contract N00014-72-C-0234; NR Proj. 323014)
(AD-758101; LMSC-D315650) Avail: NTIS CSCL 04/1

The program is directed toward an improved understanding of the sources and the energization, transport, and loss processes associated with the low-energy (keV) plasmas in the earth's magnetosphere, particularly as they relate to ionospheric perturbations and to ionospheric-magnetospheric coupling. A low-energy particle experiment is planned for flight on a polar-orbiting Air Force Satellite, and the principal efforts to date have been on modifications to the initial experiment to take into account new data on the magnetospheric plasma composition and on defining the experiment interfaces with the spacecraft in conjunction with the spacecraft Integrating Contractor and the Air Force. Author (GRA)

N73-24447# Aerospace Corp., El Segundo, Calif.
ATMOSPHERIC EXPLORER PRESSURE MEASUREMENTS: ION GAUGE AND CAPACITANCE MANOMETER Technical Report, Jul. 1971 - Oct. 1972
Carl J. Rice, Virginia L. Carter, Samuel E. LaValle, William T. Chater, and David A. Jones 15 Jan. 1973 33 p refs
(Contract F04701-72-C-0073)
(AD-757908; TR-0073(3260-10)-5; SAMSO-TR-73-103) Avail: NTIS CSCL 04/1

Absolute pressure measurements are made by two instruments aboard Atmosphere Explorer: a cold cathode ion gauge and a capacitance manometer. The dual sensors feature (1) coverage from 120 km to 370 km with double coverage below 200 km; (2) differing and complementary sensing techniques; (3) usable output in the spinning and both normal and inverted despun satellite modes; (4) simple formatting to facilitate data use for real-time monitoring of spacecraft operation; and (5) cross-calibration in the laboratory and in space. Author (GRA)

N73-24448# Aerospace Corp., El Segundo, Calif. Lab. Operations.
SOUNDING ROCKET CHEMICAL RELEASE EXPERIMENT TO MEASURE THE VIBRATIONAL TEMPERATURE OF NITROGEN IN THE UPPER ATMOSPHERE Technical Report, Jan. - Jul. 1972
Stephen J. Young 30 Mar. 1973 67 p refs
(Contract F04701-72-C-0073)
(AD-757909; TR-0073(3220-20)-3; SAMSO-TR-73-107) Avail: NTIS CSCL 04/1

The feasibility of determining the vibrational temperature of molecular nitrogen in the high atmosphere by the technique of chemical release of gaseous hydrogen iodide (HI) from a sounding rocket with ground observation of the HI first overtone radiation is considered in detail. An outline of an envisioned experiment is given, the effects of condensation and shock heating from the rapid pressure expansion of the released gas into the low-pressure atmosphere are considered, a solution of the complex problem of the diffusion of the expanded gas cloud into the atmosphere with allowance for vibrational energy transfer reactions between HI and N2 and the chemical reaction between HI and O is made, and the effects of the chemical reaction chain initiated by the HI - O reaction are considered. Author (GRA)

N73-24449# Lincoln Lab., Mass. Inst. of Tech., Lexington. 04/1
CHARACTERISTICS OF THE TROPOPAUSE AND ITS EFFECT ON OPTICAL IMAGING
Eugene S. Cotton 26 Feb. 1973 30 p refs
(Contract F19628-73-C-0002; ARPA Order 600)
(AD-758207; TN-1973-15; ESD-TR-73-64) Avail: NTIS

The note summarizes the meteorological implications of airborne optical imaging through the tropopause, with specific reference to a series of experiments in New Zealand in September 1971. The general characteristics of the tropopause and lower stratosphere are discussed as they relate to optical propagation. Specific meteorological data pertaining to the experimental flights are presented and discussed. Author (GRA)

N73-24450# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
DECELERATION AND VERTICAL MOTION OF A GAS PUFF RELEASED INTO THE UPPER ATMOSPHERE Environmental

Research Papers
Milton M. Klein 12 Jan. 1973 20 p refs
(AF Proj. 7635)
(AD-757867; AFCRL-TR-73-0046; AFCRL-ERP-431) Avail: NTIS CSCL 04/1

A study has been made of the slowing down of a gas puff released into the upper atmosphere at 100 km and its subsequent vertical motion, by use of a snow plow model. It was found that the center of mass velocity and the expansion velocity decrease to 1 percent of their initial values in about 3 seconds, at which time an ambient mass about 90 times the original mass has interacted with the gas. The temperature rise, although high initially, decreases rapidly to about 3 degrees when the vertical motion starts. For this temperature rise, the calculated values of amplitude and maximum velocity of the vertical motion were well below the observed values. Author (GRA)

N73-24451# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
COUPLED HYDROMAGNETIC MODES: INITIAL VALUE PROBLEMS
Henry R. Radoski 29 Dec. 1972 15 p refs
(AF Proj. 8601)
(AD-757866; AFCRL-72-0747; AFCRL-PSRP-524) Avail: NTIS CSCL 04/1

Before micropulsations can be utilized as a diagnostic tool, the critical theoretical problem of coupled hydromagnetic modes must be appreciated. Several alternative analyses of the steady state solutions of coupled modes have been proposed. In determining which, if any, steady state solution is of physical significance, the manner in which the hydromagnetic system evolves from an initial disturbance would be decisive. The basic initial value problems are those of field line excitation and relaxation. At present, these problems are investigated best by using a mechanical analogue of the resonant interaction between hydromagnetic modes. The transient response as well as the transmission and reflection coefficients have been calculated for the excitation problem. Analysis of the relaxation problem indicates that the characteristic frequency of the radiated signal need not be identical to the field line frequency. For the case treated, the frequency is always less and the waveform can appear as a single pulse. Results suggest that damped oscillations should be the characteristic signature of micropulsations propagated to low latitudes. Author (GRA)

N73-24452# Southern Oregon Coll., Ashland.
RAINFALL EVALUATION FROM SATELLITE PHOTOGRAPHS OF THE SUDAN Final Report
Richard M. Hammer Jan. 1973 12 p refs
(Contract DAHC04-70-C-0017)
(AD-757733; RMH-1; AROD-8799-5-EN) Avail: NTIS CSCL 04/2

The prime objective of the research is to evaluate the capability of weather satellite imagery to delineate rainfall areas. Analysis of satellite viewed clouds indicated that most major clouds or cloud systems developed in situ, development was primarily in the same geographic regions and there was limited multi-day movement of clouds. The spatial and quantitative rainfall aspects associated with meso and micro scale cloud characteristics were evaluated by projecting weather satellite imagery on daily rainfall maps. This analysis showed major precipitation, and greatest spatial coverage occurred with several well-defined linearly organized cells. (Author Modified Abstract) GRA

N73-24453# Atlantic Science Corp., Indialantic, Fla.
COMPUTER ANALYSIS OF SFERIC DATA FROM ATMOSPHERIC ANALYZERS Final Report, Feb. 1972 - Feb. 1973
Rodney B. Bent and George Nesterczuk Jan. 1973 17 p refs
(Contract N00014-71-C-0204; NR Proj. 082-265)
(AD-758102; Rept-14-2-73) Avail: NTIS CSCL 04/1

Analysis techniques of digitized data from the atmospherics analyzer are discussed along with the problems encountered in the ensuing reduction. Author (GRA)

N73-24454# Alaska Univ., College. Inst. of Arctic Environmental Engineering.
BACKSCATTER MILLIMETER WAVES FROM SNOW, ICE AND SEA ICE Final Technical Report, 1 Jun. 1971 - 31 Dec. 1972
William M. Sackinger and Robert C. Byrd 31 Dec. 1972 78 p refs
(Contract N00014-71-A-0365-0001; ARPA Order 1783)
(AD-758071; IAEE-7207) Avail: NTIS CSCL 08/12

The factors contributing to the scattering of electromagnetic waves from snow, ice, and sea ice are discussed. Laboratory measurements of the complex permittivity of sea ice as a function of temperature and salinity are reported for the frequency range 26-40 GHz. Bistatic field measurements of backscatter are also described, and results presented for a wide variety of conditions of snow cover and ice topography. Surface topography and liquid water content are dominant contributors to backscatter. Author (GRA)

N73-24455# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Technical Translation Branch.
ON THE NATURE OF THE EXTENSIVE GRAVITATIONAL ANOMALIES OF THE UKRAINIAN SHIELD
G. Ya. Golizdra and A. K. Akhmetshina Feb. 1973 24 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Fiz. Zemli (Moscow), no. 8, 1972 p 91-99
(AD-757540; DMAAC-TC-1886) Avail: NTIS CSCL 08/5

The idea of the present article is that the extensive maximums in the Ukrainian shield are not connected with a continuous development of dense rocks, but only with their impregnation. However, on the average, the density of rocks within the maximums has an increased value in comparison with the surrounding territory. The main content of the present report is based on a corresponding model of the crustal structure. Author (GRA)

N73-24456# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Technical Translation Branch.
ON VAISALA'S METHOD
O. S. Razumov Dec. 1972 18 p refs Transl. into ENGLISH from Geodez. i Kartograf (Moscow), no. 3, 1972 p 15-21
(AD-757542; DMAAC-TC-1889) Avail: NTIS CSCL 08/5

The paper discusses Vaisala's method of stellar triangulation, taking into consideration the geometric structure of the system being adjusted, the unequal accuracy of measurements at the stations and the systematic errors of registration of the moments of observations. (Author Modified Abstract) GRA

N73-24457# Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
PRESENT AND PALEO-CLIMATIC INFLUENCES ON THE GLACIERIZATION AND DEGLACIERIZATION OF CUMBERLAND PENINSULA, BAFFIN ISLAND, N. W. T., CANADA Final Technical Report, 1969 - Oct. 1972
John J. Andews and Roger G. Barry Oct. 1972 227 p refs (Grants DA-ARO(D)-31-124-G1163; DA-ARO(D)-31-124-70-G80) (AD-757270; INSTAAR-Occasional-Paper-2; AROD-8000-15-EN) Avail: NTIS CSCL 08/12

The purpose of the research discussed in this report was to attempt an integrated analysis of the past and present climates of the northern Cumberland Peninsula region with specific attention focused on the links between glacier distribution and fluctuations and the climate. The final objective of the research is to attempt to model the paleoclimate of the region during the late Quaternary. GRA

N73-24458# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
AN INSTRUMENT FOR MEASURING DEEP OCEAN PRESSURE FLUCTUATIONS Ph.D. Thesis. Final Report
Albert Meyer Bradley 17 Jan. 1973 173 p refs
(Contract N00014-67-A-0204-0048; NR Proj. 083-157)
(AD-757098; Rept-73-1) Avail: NTIS CSCL 08/10

The report describes the design, construction, and testing of a system to measure deep ocean pressure fluctuations. The system is based on a new type of pressure transducer, the quartz crystal resonator pressure sensor, which appeared particularly well adapted for use in the deep ocean. (Author Modified Abstract) GRA

N73-24459# Defense Mapping Agency Aerospace Center, St. Louis, Mo.
ANALYSIS AND TECHNIQUES TO DETERMINE EARTH GRAVITATIONAL MODELS
Haschal L. White Jan. 1973 39 p refs
(AD-756177; DMAAC-TP-73-1) Avail: NTIS CSCL 08/5

Research is in progress at the Defense Mapping Agency Aerospace Center (DMAAC) to develop an improved earth gravitational model from a combination of satellite tracking and surface mean free-air gravity anomaly data. Analysis and techniques for obtaining combination solutions as well as the resulting gravitational model evaluation procedures are discussed. For comparison purposes, some of the evaluation procedures applied to the DMAAC derived and the 1969 Smithsonian Standard Earth (II) gravitational models are presented.
Author (GRA)

N73-24460# Mainz Univ. (West Germany). Inst. fuer Meteorologie.
RESEARCH ON ATMOSPHERIC RADIATION TRANSMISSION Scientific Report, 1 Jan. - 31 Dec. 1972
E. DeBary, K. Bullrich, R. Eiden, G. Eschelbach, and G. Hanel Feb. 1973 25 p refs
(Grant AF-AFOSR-2252-72; AF Proj. 7621)
(AD-758771; AFCRL-TR-73-0149) Avail: NTIS CSCL 04/1

Contents: The influence of the aerosol particles on the energy balance of the atmosphere in the visible range of the solar spectrum; The ratio of primary scattering to total scattering of sky radiance; Determination of the scattering coefficient of turbid air with integrating nephelometers; The ratio of the extinction coefficient to the mass of atmospheric aerosol particles as a function of the relative humidity; Fourier representation of the electromagnetic field scattered by spherical absorbing particles.
GRA

N73-24461# Army Electronics Command, Fort Monmouth, N.J.
IONOSPHERIC EFFECTS DURING THE PARTIAL SOLAR ECLIPSE OF 10 JULY 1972
H. Soicher and F. J. Gorman, Jr. Mar. 1973 13 p refs
(DA Proj. 1T0-61102-B-31A)
(AD-758855; ECOM-4097) Avail: NTIS CSCL 04/1

Polarization measurements at Fort Monmouth, N.J., using ATS-3 emitted signals and bottomside ionospheric sounding measurements at the subionospheric point were performed during the partial solar eclipse of 10 July 1972. A decrease in the total electron content and the plasma temperature ensued with corresponding diffusive particle fluxes into heights of maximum ionization. The diffusion rate to the height of maximum ionization was comparable to the recombination rate at that altitude.
Author (GRA)

N73-24462# Illinois Inst. of Tech., Chicago. Dept. of Mechanics, Mechanical and Aerospace Engineering.
ON MODELING OF ATMOSPHERE SURFACE LAYERS BY THE COUNTER-JETS TECHNIQUES: PRELIMINARY RESULTS
M. V. Morkovin, H. M. Nagib, and J. T. Yung Oct. 1972 26 p refs
(Contract F44620-69-C-0022; AF Proj. 9560; Proj. Themis)
(AD-758888; THEMIS-IIT-TR-R-72-7; AFOSR-73-0592TR) Avail: NTIS CSCL 04/2

Thick turbulent boundary layers intended to simulate neutral atmospheric layers are generated in wind tunnels by the natural long-fetch technique in long tunnels and by various drag-and turbulence-producing obstructions in short tunnels. The target atmospheric layers actually consist of a succession of quasi-equilibrium boundary layers diffusing within older boundary layers as the ground roughness and topography change. Some philosophy for testing of aerodynamic characteristics of models of proposed buildings is drawn from comparison of the above layers. (Author Modified Abstract)
GRA

N73-24463# Rhode Island Univ., Kingston. Dept. of Electrical Engineering.
ELECTRICAL CONDUCTIVITY OF THE MESOSPHERE (40 km TO 100 km) FROM ELF SPECTRA Final Report, 16 Nov. 1969 - 15 Nov. 1972
Anh Tran and Charles Polk 15 Feb. 1973 44 p refs
(Contract F19628-70-C-0090; AF Proj. 5631)
(AD-758775; AFCRL-TR-73-0168; Rept-4255/3; FR-3) Avail: NTIS CSCL 04/1

The Schumann resonance frequencies of the Earth-Ionosphere cavity at approximately 8, 14 and 20 Hz provide a method for obtaining a world average of the (zero-magnetic field) electrical conductivity of the Ionosphere down to 40 km altitude. If the cavity Q or wave attenuation can be accurately measured, the average electrical conductivity below 40 km can also be determined. Numerical models are analyzed to show the effect of conductivity changes at various altitude ranges upon the resonance frequencies. Several conductivity profiles for periods corresponding to different levels of solar activity are derived from experimentally determined Schumann resonance frequencies.
Author (GRA)

N73-24464# Aerospace Corp., El Segundo, Calif.
GLOBAL DISTRIBUTION OF THERMOSPHERIC HEAT SOURCES: EUV ABSORPTION AND JOULE DISSIPATION Technical Report, Sep. - Dec. 1972
Barbara K. Ching and Yam T. Chiu 1 Mar. 1973 39 p refs
(Contract F04701-73-C-0073)
(AD-758758; TR-0073(3260-10)-9; SAMSO-TR-73-139) Avail: NTIS CSCL 04/1

The global distribution and temporal variations of thermospheric heating due to Joule dissipation of measured ionospheric electric fields are computed. It is shown that the volume Joule dissipation rate is similar in magnitude and altitudinal profile to the global solar EUV absorption rate discussed in the previous papers. Thus, Joule dissipation contributes significantly towards reconciling the quantitatively known sources of thermospheric heat input and that required to maintain the normal thermosphere. The combined heat source due to EUV absorption and Joule dissipation varies with the annual cycle in a manner closely resembling that of the thermospheric density.
Author (GRA)

N73-24465# Aerospace Corp., El Segundo, Calif. Lab. Operations.
OBSERVATIONS OF ATMOSPHERIC OZONE AT 110.836 GHz Technical Report, Apr. - Oct. 1972
Fred I. Shimabukuro and William J. Wilson 9 Feb. 1973 20 p refs
(Contract F04701-72-C-0073)
(AD-758819; TR-0073(9230-30)-5; SAMSO-TR-73-134) Avail: NTIS CSCL 04/1

The 6(0,6) - 6(1,5) transition line of ozone has been detected in both absorption and emission in the earth's atmosphere. The peak absorption is about 3.4% of the continuum. Comparisons of the measured spectrum are made with calculated ones based on previous theoretical treatments and measurements of parameter values.
Author (GRA)

N73-24466# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
A THREE-DIMENSIONAL MODEL OF THE THERMOSPHERE WITH AURORAL HEAT
Raivo Vest 6 Feb. 1973 182 p refs
(Contract N00014-67-A-0385-0017)
(AD-758733; PSU-IRL-Sci-412; SR-412) Avail: NTIS CSCL 04/1

A three-dimensional steady state model of the dynamics of the upper atmosphere is developed by the simultaneous solution of the equations of continuity, conservation of momentum, and conservation of energy over the entire upper atmosphere. Detailed consideration is given to the diffusion processes, the shear stresses, and the energy transport mechanisms, and to the thermal conductivity and viscosity effects in a multicomponent mixture. The resulting system of equations is solved by a digital computer to yield realistic values for the temperatures, densities, and nighttime winds in the upper atmosphere. The daytime winds are over estimated by about a factor of three, since the effects due to collisions with ionized components were neglected. A reasonable profile of the auroral heating input during solar storms is incorporated into the model and the effect produced by this heating on the upper atmosphere is evaluated.
Author (GRA)

N73-24467# Woods Hole Oceanographic Institution, Mass.
PHYSICAL PROPERTIES AND SUSPENDED MATTER OF SURFACE WATERS IN THE SOUTHEASTERN ATLANTIC OCEAN Technical Report, Jan. - Jul. 1972
K. O. Emery, J. D. Milliman, and Elazar Uchupi Jan. 1973 49 p refs
(PB-214813/8; WHOI-73-1; WHOI-Contrib-3000) Avail: NTIS HC $3.00 CSCL 08J

Samples of suspended matter in surface waters were obtained at about 750 stations in the southeastern Atlantic Ocean during a 5.5-month geophysical cruise of R/V ATLANTIS 2. Concentrations were found to be related to patterns of upwelling as outlined by observations of wind direction and speed, surface water temperature, salinity, and color, seabird distribution and abundance, and the surface current pattern. The suspended matter is chiefly organic in origin owing to the high productivity of upwelled water on the continential shelf and south of the Subtropical Convergence. Author (GRA)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N73-24468* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DATA USERS' NOTE: APOLLO 16 LUNAR PHOTOGRAPHY
Winifred Sawtell Cameron, Frederick J. Doyle (Geol. Survey), Mary Anne Niksch (KMS Technol. Center), Kathleen Hug, Leon Levenson, and Kenneth Michlovitz (PMI Facilities Management Corp.) May 1973 65 p
(NSSDC-73-01) Avail. National Space Science Data Center, NASA Goddard Space Flight Center, Greenbelt, Md. 20771 CSCL 14E

Announcement is made of the availability of Apollo 16 pictorial data, along with aids for the investigator in selecting pertinent photographs for study. A brief description of the Apollo 16 mission and mission objectives is also provided in terms of photograph selection. J.M.M.

N73-24469* Defense Mapping Agency Aerospace Center, St. Louis, Mo.
APOLLO MISSION 16 LUNAR PHOTOGRAPHY INDEX MAPS
Oct. 1972 29 p refs Sponsored by NASA
(NASA-CR-132066) Avail: National Space Science Data Center, Goddard Space Flight Center, Greenbelt, Md. CSCL 14E

A map index on lunar photographs taken by the Apollo 16 spacecraft is presented. E.H.W.

N73-24470 National Lending Library for Science and Technology, Boston Spa (England).
SCANNING-ELECTRON-MICROSCOPY OF DIELECTRICS
G. V. Spivak and E. J. Rau 8 Feb. 1973 9 p refs Transl. into ENGLISH from Bull. Acad. Sci. USSR Phys. Ser. (Moscow), v. 36, no. 6, Jun. 1972 p 1312-1315
(NLL-DRIC-Trans-2970-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The problem of body and surface charging in dielectric samples, with low conductivity, scanned by electron microscopes is discussed. Several methods were used to prevent such charging. The methods include adding conductivity to sample films, reducing accelerating voltage when coefficient of secondary emission is near 1, and using a microscope with a impulse arrangement. The use of irradiation by auxiliary guns with slow electrons to remove charging is also discussed. E.H.W.

N73-24471 National Lending Library for Science and Technology, Boston Spa (England).
A PHOTOELECTRIC PYROMETER
P. F. Gelfand [1973] 3 p Transl. into ENGLISH from Stal (Moscow), v. 11, 1972 p 1060
(NLL-M-21634-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The characteristics of a photoelectric pyrometer for measuring the temperature of wire with a diameter not less than one millimeter during the heat treatment of wire rod rolling are discussed. The pyrometer consists of a sighting head, a power unit, and an electronic potentiometer. The sighting head has an optical receiver, a photo receiver, and an obdurator with a rectangular slit oscillating at a frequency of twenty five cycles per second in the plane of the image of the wire. Author

N73-24472* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMOCOUPLE TAPE Patent
Ralph D. Thomas, inventor (to NASA) Issued 24 Apr. 1973 5 p Filed 8 Jan. 1971 Supersedes N71-31123 (09 - 18, p 2924)
(NASA-Case-LEW-11072-1; US-Patent-3,729,343; US-Patent-Appl-SN-104885; US-Patent-Class-136-225) Avail: US Patent Office CSCL 14B

A thermocouple which may be rolled as a tape until needed and a method of making it are described. Thermoelectrically different metals are applied to a strip of electrically nonconductive material in longitudinally overlapping relationship. Apertures may be provided along the tape in overlapping region at predetermined intervals. An adhesive material is applied to the side of the tape opposite the thermoelectric metals either before or after the thermoelectric metals are deposited. The tape may be cut or torn to form a thermocouple device which is ready for application to a body whose temperature is to be monitored or measured. Official Gazette of the U.S. Patent Office

N73-24473* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RATEMETER Patent
James R. Currie and Ralph R. Kissell, inventors (to NASA) Issued 18 Jun. 1973 9 p Filed 13 Jul. 1971 Supersedes N71-34386 (09 - 21, p 3427)
(NASA-Case-MFS-20418; US-Patent-3,729,676; US-Patent-Appl-SN-162101; US-Patent-Class-324-78E; US-Patent-Class-128-206F) Avail: US Patent Office CSCL 14B

An instantaneous reading tachometer in which reoccurring events to be measured in rate, trigger a threestate timing generator in which the first two states are of fixed duration and the third state is of variable duration is described. An electrical decay circuit is set to a reference level by the second state and the third state causes this reference level to decay until the reoccurrence of an event. This triggers a new first state which in turn triggers a sample and hold circuit to hold the decayed level. The decayed level is amplified and provided as an output indicative of the instantaneous rate of occurence of the last two successive events. Official Gazette of the U.S. Patent Office

N73-24474 Idaho Univ., Moscow.
A DERIVATIVE OPTICAL SPECTROMETER FOR STUDYING THE OPTICAL PROPERTIES OF SOLIDS Ph.D. Thesis
Paul Gerald Hart 1972 98 p
Avail: Univ. Microfilms Order No. 72-30500

A unique derivative spectrometer is described, which is capable of operating from the vacuum UV to the far IR with a signal-to-noise ratio approaching the theoretical limit of photon-shot noise in certain regions, and with a very high optical resolution. The wavelength of the light beam is modulated using a vibrating mirror driven by an electric torsional oscillator at 380 Hz. A dual-beam optical system, utilizing only mirrors and a single detector, is described. To perform the compensation and normalization operations, a unique solid state signal processor was designed. This particular approach permits the use of essentially any light detector. To demonstrate the power of the wavelength-modulation method with this instrument, the logarithmic derivative transmission spectra of a standard holmium oxide filter were measured and analyzed under a variety of system parameters. No measurable errors in the normalization and compensation operations were seen in this data. Dissert. Abstr.

N73-24475# Defence Research Establishment Valcartier (Quebec).

A HIGH-SPEED SYNCHRONOUS SHUTTER FOR SPECTROGRAPHIC AND OTHER APPLICATIONS IN THE HYPERSONIC RANGE
A. R. Emond Oct. 1972 25 p refs
(DREV Proj. 95-51-10)
(DREV-TN-1997/72) Avail: NTIS HC $3.25

A description is given of two relatively simple high speed electromechanical focal plane shutters. The first shutter was developed for spectrographic studies of the wakes of hypersonic projectiles launched in ballistic ranges. It is capable of speeds up to 9.2 meters per second, taking 4 milliseconds to cover a 35 mm film gate. An improved model was developed for possible application to color schlieren photography. This second shutter is capable of speeds up to 28.8 meters per second, taking 1.2 milliseconds to cover a 35 mm film gate. Author

N73-24476# Defence Research Establishment Valcartier (Quebec).
EVALUATION OF THE IMAGE FORMING ABILITY OF AN INFRARED LINE SCAN SYSTEM
G. A. Morley, D. McKinnon, and R. Erickson Oct. 1972 9 p refs Presented at the Soc. of Photo-Optical Instrumentation Engr. Seminar-in-Depth on Develop. in Electron. Imaging Tech., San Francisco, 17 Oct. 1972
Avail: NTIS HC $3.00

The image forming ability of an IRLS system has been assessed by means of laboratory measurements and in-flight testing using a ground test array. The laboratory tests have included determination of the over-all system modulation transfer function, amplitude characteristics and the minimum resolvable temperature. The ground test array consists of a 3-bar wedge pattern and a radiance step constructed of dissimilar panels of painted and sand-blasted aluminum. Analysis of the imagery resulting from over-flying the array yields data of the amplitude characteristics and the noise-limited resolution of the system. Author

N73-24477# National Aerospace Lab., Tokyo (Japan).
EXPERIMENTS ON AIRSPEED CALIBRATION PROCEDURES
Jiro Koo, Toichi Oka, Yukichi Tsukano, Kenti Yazawa, and Takatsugu Ono 1973 19 p refs In JAPANESE; ENGLISH summary
(NAL-TR-298) Avail: NTIS

The position errors of airspeed measuring systems and the cause of such errors are reported. Flight tests were made on six procedures. These include trailing cone or bomb, tower, radar altimeter, speed course, swiveling pitot-static tube, and airplane pacing methods. Author

N73-24478# Aeronautical Research Labs., Melbourne (Australia).
THE DEVELOPMENT OF AUTOMATED EDDY CURRENT EQUIPMENT FOR USE IN NONDESTRUCTIVE TESTING
H. R. ChinQuan and I. G. Scott Sep. 1972 46 p refs
(ARL/Met-Note-84) Avail: NTIS HC $4.50

An automated scanning and display system was developed to overcome difficulties associated with manual scanning using eddy current probes. The system comprises (1) a mechanism whereby the test probe automatically scans an area on the specimen, and (2) a display unit which records the output and position co-ordinates of the probe. Test results for (printed circuit board) specimens containing artificial defects illustrate the potential of the system. Author

N73-24479*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMPLEMENTATION OF A SELF-CONTROLLING HEATER
Maxwell G. Strange Washington May 1973 16 p
(NASA-TN-D-7248; G-7316) Avail: NTIS HC $3.00 CSCL 14B

Temperature control of radiation sensors, targets, and other critical components is a common requirement in modern scientific instruments. Conventional control systems use a heater and a temperature sensor mounted on the body to be controlled. For proportional control, the sensor provides feedback to circuitry which drives the heater with an amount of power proportional to the temperature error. It is impractical or undesirable to mount both a heater and a sensor on certain components such as ultra-small parts or thin filaments. In principle, a variable current through the element is used for heating, and the change in voltage drop due to the element's temperature coefficient is separated and used to monitor or control its own temperature. Since there are no thermal propagation delays between heater and sensor, such control systems are exceptionally stable. Author

N73-24480# Joint Publications Research Service, Arlington, Va.
MAGNETOMETERS
8 May 1973 20 p refs Transl. into ENGLISH of Geofiz. App. (Leningrad), no. 48, 1972
(JPRS-58950) Avail: NTIS HC $3.00

Magnetometer research is reported under the following headings: (1) measurement errors of rubidium vapor magnetometers, (2) structure of the working signal of the rubidium vapor magnetometer, and (3) design and operation of an observatory vector magnetometer. For individual titles, see N73-24481 through N73-24483.

N73-24481 Joint Publications Research Service, Arlington, Va.
MEASUREMENT ERRORS OF RUBIDIUM VAPOR M SUB Z-MAGNETOMETER
V. D. Lomanyy and B. F. Polyakov *In its* Magnetometers 8 May 1973 p 1-8 refs (For availability see N73-24480 15-14)

Equations are given for calculating the tolerable mean square random errors of the basic parameters of the magnetometer circuitry. Separate formulations are shown for computing the errors in magnetometers with static servosystems and those with astatic servosystems. D.L.G.

N73-24482 Joint Publications Research Service, Arlington, Va.
ON THE STRUCTURE OF THE WORKING SIGNAL OF THE RUBIDIUM VAPOR M SUB Z MAGNETOMETER
G. S. Vasyutochkin and V. D. Lomanyy *In its* Magnetometers 8 May 1973 p 9-14 ref (For availability see N73-24480 15-14)

It is pointed out that the working signal produced during low frequency scanning of the external field, is an unresolved line, combining the lines of four magnetic transition signals that are close together on the frequency scale. The amplitude of the scanning field and the choice of position of the scanning interval relative to the peak of the working signal are, therefore, related to the specific shape of the signal. In order to calculate the shape of the signal in the entire measurement range, an investigation was made to determine to which intensity ratio of the singular magnetic transition lines the actually observed curves of the signal correspond. The results of the study indicate that in order to draw the diagram of measurement of the magnetic field and its gradient, it is necessary to know: the shape of the summary curve of the signal in the maximum region, the asymmetry of the curve, and the indices of maximum steepness of the curve on both sides of the peak. It is concluded that these are the characteristics that govern the choice of scanning amplitude and radio field amplitude. D.L.G.

N73-24483 Joint Publications Research Service, Arlington, Va.
AN OBSERVATORY VECTOR MAGNETOMETER
V. I. Myukhkyurya *In its* Magnetometers 8 May 1973 p 15-17 refs (For availability see N73-24480 15-14)

The design and operation is described of a nuclear precision magnetometer for measuring the T, Z, and H components of the earth's magnetic field. Measurements are made by the three moduli method using two independent internal systems; the major system designed for compensating the vertical component, and the minor system for compensating the horizontal component. The design of the instrument permits separate alignment of the magnetic axes of the systems during observation, and bias fields are produced by either system. D.L.G.

N73-24484*# Universal Monitor Corp., Pasadena, Calif.
COUNTER TUBE WINDOW AND X-RAY FLUORESCENCE ANALYZER STUDY
R. Hertel and M. Holm 20 Mar. 1973 113 p Revised
(Contract NAS2-7356)
(NASA-CR-114619; UMC-1116-FR) Avail: NTIS HC $7.75 CSCL 14B

A study was performed to determine the best design tube window and X-ray fluorescence analyzer for quantitative analysis of Venusian dust and condensates. The principal objective of the project was to develop the best counter tube window geometry for the sensing element of the instrument. This included formulation of a mathematical model of the window and optimization of its parameters. The proposed detector and instrument has several important features. The instrument will perform a near real-time analysis of dust in the Venusian atmosphere, and is capable of measuring dust layers less than 1 micron thick. In addition, wide dynamic measurement range will be provided to compensate for extreme variations in count rates. An integral pulse-height analyzer and memory accumulate data and read out spectra for detail computer analysis on the ground. Author

N73-24485*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
A LINEAR SHIFT-INVARIANT IMAGE PREPROCESSING TECHNIQUE FOR MULTISPECTRAL SCANNER SYSTEMS
C. D. McGillem and T. E. Riemer 1973 57 p refs
(Grant NGL-15-005-112)
(NASA-CR-132957; LARS-022673) Avail: NTIS HC $5.00 CSCL 14E

A linear shift-invariant image preprocessing technique is examined which requires no specific knowledge of any parameter of the original image and which is sufficiently general to allow the effective radius of the composite imaging system to be arbitrarily shaped and reduced, subject primarily to the noise power constraint. In addition, the size of the point-spread function of the preprocessing filter can be arbitrarily controlled, thus minimizing truncation errors. Author

N73-24486*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA-RAY SPECTROMETER EXPERIMENT, APOLLO 17: NaI(T1) DETECTOR CRYSTAL ACTIVATION Preliminary Science Report
J. I. Trombka, R. L. Schmadebeck, M. Bielefeld (Computer Sciences Corp.), G. D. OKelley (ORNL), J. S. Eldridge (ORNL), K. J. Northcutt (ORNL), A. E. Metzger (JPL), E. Schonfeld, L. E. Peterson (Calif. Univ., San Diego), J. R. Arnold (Calif. Univ., San Diego) et al Mar. 1973 10 p refs
(NASA-TM-X-66241; X-641-73-93) Avail: NTIS HC $3.00 CSCL 14B

An attempt was made to obtain experimental data on proton induced activity and its effect on gamma ray spectral measurements. A NaI(T1) crystal flown in Apollo 17 command module was used for the experiment. E.H.W.

N73-24487*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMAGE DISSECTOR DEVELOPMENT
W. C. Goss 15 Apr. 1973 18 p refs
(Contract NAS7-100)
(NASA-CR-132153; JPL-TM-33-608) Avail: NTIS HC $3.00

A second-generation electrostatically focused image dissector tube for use in spacecraft attitude control star trackers is being developed with the support of an industrial contractor. Significant improvements are being made in functional characteristics, as well as in package dimensional control, tolerance of a wide variety of environmental conditions, and expected reliability over long operational lifetimes. Author

N73-24488*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PERFORMANCE CHARACTERISTICS OF PROXIMITY FOCUSED ULTRAVIOLET IMAGE CONVERTERS
Jack T. Williams and Walter A. Feibelman May 1973 26 p refs Submitted for publication
(NASA-TM-X-66258; X-673-73-144) Avail: NTIS HC $3.50 CSCL 14B

Performance characteristics of Bendix type BX 8025-4522 proximity focused image tubes for ultraviolet to visible light conversion are presented. Quantum efficiency, resolution, background, geometric distortion, and environmental test results are discussed. The converters use magnesium fluoride input windows with Cs - Te photocathodes, and P-11 phosphors on fiber optic output windows. Author

N73-24489# National Oceanographic Instrumentation Center, Washington, D.C.
MODEL 9040-5C, CTD-SV ENVIRONMENTAL PROFILING SYSTEM, PLESSEY ENVIRONMENTAL SYSTEMS, SAN DIEGO, CALIFORNIA 92138
May 1973 12 p
(NOAA-IFS-73009) Avail: NTIS HC $3.00

An instrument for obtaining continuous profiles of ocean conductivity, temperature, and sound velocity as functions of depth is described. Performance specifications of the instrument are reported. A block diagram of the circuit components is developed. Curves are prepared to show the performance of the instrument and calibration standards. P.N.F.

N73-24490*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
TRAVERSE GRAVIMETER EXPERIMENT Final Report
Sheldon W. Buck Apr. 1973 150 p refs
(Contract NAS9-11555; DSR Proj. 55-45100)
(NASA-CR-128948; R-739) Avail: NTIS HC $9.50 CSCL 14B

A semiautomatic self-leveling lunar gravimeter has been designed for the Apollo 17 mission. This traverse gravimeter, which is completely self-contained and powered by an internal battery, was used to measure gravity at predetermined stops along the route of the Lunar Rover Vehicle. The gravity sensor is a vibrating string accelerometer (VSA) enclosed in a temperature-controlled oven and gimballed leveling assembly. This instrument is capable of resolving gravity differences as small as 0.035 milligal (1 mgal = 0.001 cm/s) on the moon and yet also is able to measure the earth's gravity field of 980,000 milligals. Twenty-two measurements were taken on the moon during the Apollo 17 mission, during which the VSA temperature never varied more than 0.005 C. The flight results indicate an instrument accuracy of better than 2 mgal. Author

N73-24491*# Eastman Kodak Co., Rochester, N.Y. Kodak Apparatus Div.
PHOTOGRAPHIC CONSULTING SERVICES FOR EARTH RESOURCES PROGRAM AT NASA GODDARD SPACE FLIGHT CENTER
21 Mar. 1973 63 p
(Contract NASw-2317)
(NASA-CR-131819) Avail: NTIS HC $5.25 CSCL 14E

A comparison of prints from ERTS photography revealed significant differences in the image quality produced at GSFC, the EROS facility at Sioux Falls, and Eastman Kodak in Rochester. Based on this survey photographic quality was improved significantly at Sioux Falls, and improvements were suggested for optical and contact printers at the GSFC. Based on a test in which 365 meters of Eastman Electron Recording Film (ESTAR Base) SO-438 were processed the 1-sigma variation in process control from all sources is about + or - 0.04 at a density of 1.0. Variations from film and from processing were approximately equal contributors to the overall tolerance. Distortion produced by the Kodak Colorado printer at GSFC covers a range of about 0.04%, a small value compared to that caused by other factors in the ERTS system. The edge fringing inherent in the color film materials used at GSFC also seems to be a small factor in the unsharpness of ERTS color prints. MTF and granularity measurements were made on processed film samples supplied by GSFC. MTF values were above 0.70 out to 42 cycles/mm for all stages of contact printing in the ERTS system. Author

N73-24492*# Itek Corp., Lexington, Mass. Optical Systems Div.
PHOTOHELIOGRAPH THERMAL CONCEPTS STUDY. VOLUME 2: DETAILED ANALYSIS Final Report
17 Apr. 1973 158 p refs
(Contract NAS8-28520)
(NASA-CR-124255; ITEK-73-8220-3-Vol-2) Avail: NTIS HC $10.00 CSCL 20F

The photoheliograph thermal concepts study which was to define and compare the performance of thermal subsystem concepts for each of three photoheliograph designs oriented toward unique solar observation missions is reported. These design and missions are categorized as: (1) A 150-centimeter photoheliograph for large solar observatory (LSO) missions. This design

is intended for multiyear orbital operations as a part of a complement of solar telescopes in a free-flying LSO configuration. (2) A 100-centimeter photoheliograph for shuttle sorties. This design is intended for observation periods of up to 2 weeks while mounted in the cargo bay of the shuttle orbiter vehicle. (3) A 100-centimeter photoheliograph for balloon missions. This design is intended to be a design verification unit and precursor to the orbital flight designs. Mission duration is on the order of a single day at an altitude of approximately 24.4 kilometers. For each of these photoheliograph designs, the basic thermal environments, boundary conditions, and applicable thermal control concepts were defined and the interactions between concepts and environments were determined. A baseline thermal control concept was selected for the three classes of photoheliographs described. Author

N73-24493# Research Inst. of National Defence, Stockholm (Sweden).
HIGH INTENSITY PULSED ELECTRON BEAM SYSTEM
A. Mattsson Nov. 1972 11 p refs
(FOA-2-2579-E8) Avail: AEC Depository Libraries

The design and performance of a high-intensity pulsed electron beam system, operating at 600 kV, is discussed. The emitted peak current is 5.7 kA, the pulse length 25 ns, and the calculated dose rate 3.6 X 10 to the 14th power rad/s. Author (NSA)

N73-24494# European Atomic Energy Community, Ispra (Italy).
STUDIES OF CERTAIN CHARACTERISTICS OF AN EMITTING-RECEIVING ULTRASONIC PROBE. PART 1: STUDY OF THE CONFIGURATION OF THE ULTRASONIC BEAM. PART 2: DETERMINATION OF THE ELECTRIC EQUIVALENT CIRCUIT OF A TRANSDUCER
G. J. A. Juranville Dec. 1972 132 p refs
(EUR-4774) Avail: AEC Depository Libraries; EUR FB 175

The ultrasonic immersion testing method for detecting flaws in metals is very critical, especially when quantified results are required. The probe should have a high sensitivity for detecting small discontinuities and a short ringing time to discriminate clearly reflections from the material boundaries and adjacent defects. To insure reproductive results it is absolutely necessary to have precise information concerning the sound beam and the electrical data of each transducer. To assemble these characteristics on a transducer data-sheet, the sound beam was investigated and the electrical behavior of the transducer was analyzed. Results of studies on configuration of the ultrasonic beam are presented along with data for determination of the electric equivalent circuit of a transducer. Author (NSA)

N73-24495# Centre National de la Recherche Scientifique, Vitry (France).
UTILIZATION OF A SEMICONDUCTOR DETECTOR IN THE SYSTEMATIC ANALYSIS OF Al
J. Blouri, M. Fedoroff, and G. Revel 1972 11 p refs In FRENCH Presented at the Intern. Colloq. on the Activation Analysis of Micro-quantities of Elem. in Very High Purity Inorg. and Org. Substances and in Biol. Media, Saclay, France, 2-6 Oct. 1972
(FRNC-Conf-75; Conf-721069-1) Avail: AEC Depository Libraries

After irradiating Al samples (of various origins) with a 3 x 10 to the 12th power n/sq cm/sec neutron flux, some 30 elements can be determined without chemical separation. A description is given of the way in which the measurements are made and the radioactivity calculations performed. The detection limits are indicated. They lie between 0.05 and 0.000005 ng/g depending upon the element sought. For certain of these elements (Fe, Zn, and Zr) these limits can be improved by a simple chemical separation. NSA

N73-24496# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. fuer Aerobiologie.
AEROSOL BEAM SPECTROMETER [EIN AEROSOLSTRAHL-SPEKTROMETER]
B. E. Dahneke and H. Flachsbart Bonn Bundeswehramt 1973 15 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-73-6) Avail: NTIS HC $3.00; Bundeswehramt, Bonn 25 DM

Two methods of using an aerosol jet device as a particle size spectrometer are described. A condition for such a device is a dynamic focusing facility, the construction and functioning of which is described. The particle size spectrometry is then obtained by a lateral air jet or an asymmetric expansion of the aerosol entering the vacuum chamber. Results of measurements with monodisperse latex aerosols are presented. ESRO

N73-24497# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RAREFIED GAS PROBING BY ELECTRON BEAM APPLIED TO AERODYNAMIC FLOWS Ph.D. Thesis - Paris Univ. [SONDAGE DE GAZ RAREFIES PAR FAISCEAU D'ELECTRONS APPLIQUE AUX ECOULEMENTS AERODYNAMIQUES]
Serge Lewy Nov. 1972 33 p refs In FRENCH; ENGLISH summary
(ONERA-P-146) Avail: NTIS HC $3.75

An electron beam rarefied gas technique is presented and described. The characteristics of this method, used for analysis of hypersonic flow in air and nitrogen, consists of a light emission and permits the determination of various parameters of the gas in its initial state. Visualization of thin sections of the flow is obtained either from the light emitted on the electron beam path, or, in pure nitrogen thanks to the secondary afterglow phenomenon. The molecular distribution and rotational and vibrational temperature were determined. ESRO

N73-24498# European Space Research Inst., Frascati (Italy).
THE PARALLEL PLATE CONDENSER AS A RELATIVISTIC PARTICLE ANALYSER
Georges A. Proca 29 Mar. 1972 44 p refs Submitted for publication
Avail: NTIS HC $4.25

A fully analytical study of the properties of the parallel plate electrostatic spectrograph in the relativistic region is presented. The formalism used allows for an exact tridimensional treatment whereby the coupling between the polar angles theta, phi appears through the quantity alpha = d phi/d theta only while the explicit expression of alpha (theta, phi) remains unspecified. This freedom in the choice of the relationship phi = f(theta) may be used to improve on the properties of the instrument. A numerical calculation of the basic parameters of a spectrograph suited for astrophysical research is given stressing the possibility of flying such an instrument aboard a space shuttle within the Post Apollo program. Author (ESRO)

N73-24499# European Space Research Inst., Frascati (Italy).
MINIMIZATION OF FRINGING FIELD EFFECTS IN THE PARALLEL PLATE ELECTROSTATIC SPECTROGRAPH
Georges A. Proca and Christian Ruedinger (Christian Rovsing Ltd., Copenhagen) Mar. 1973 28 p refs Submitted for publication
Avail: NTIS HC $3.50

The effects of fringing fields at the entrance and exit windows of the parallel plate electrostatic analyzer on the trajectory of particles was studied, taking into account the finite thickness of the condenser plate bearing the windows. The influence of the physical dimensions of the spectrograph on the field variation was assessed together with that of a grounded plate parallel to the condenser and located in the entrance - exit region. A set of inequalities expressed in terms of the physical dimensions of the instrument was deduced to define a reference model spectrograph of known characteristics and minimal electric field distortion with the help of which any actual instrument may be studied using the electrostatic scaling laws. Author (ESRO)

N73-24500# Army Foreign Science and Technology Center, Charlottesville, Va.
SCIENTIFIC-TECHNICAL CONFERENCE OF THE NOVOSIBIRSK INSTITUTE OF ENGINEERS IN GEODESY AEROPHOTOGRAPHY AND CARTOGRAPHY
V. V. Buzuk 1 Nov. 1972 5 p Transl. into ENGLISH from Geodez. Kartograf. (Moscow), no. 8, 1971 p 72-73
(AD-758290; FSTC-HT-23-1092-72) Avail: NTIS CSCL 08/5

The 22d Scientific-Technical Conference of the Novosibirsk Institute of Engineers in Geodesy, Aerophotography and Cartogra-

phy and of the Novosibirsk Branch of the All-Union Astronomical and Geodetic Society was held 12-19 April 1971. Over 650 representatives of scientific, educational and industrial organizations in Novosibirsk and other cities took part in the work of the conference. Such topics as: geodesy, topography, cartography, photography, astronomy, gravimetry, spectroscopy, and chemistry were covered. Author (GRA)

N73-24501# Meteorology International, Inc., Monterey, Calif.
TECHNIQUES FOR OPERATIONAL EXPLOITATION OF SATELLITE INFRARED SPECTROMETER (SIRS) DATA FOR RESOLUTION OF ATMOSPHERIC VARIABILITIES, TASK 2
Manfred M. Holl 15 Mar. 1973 4 p
(Contract N62306-72-C-0125)
(AD-757774; M-181-2) Avail: NTIS CSCL 04/2

The report describes the development of techniques for operational use of SIRS data for resolving atmospheric variables. Task two consists of additional formulations relating specific designed mass-structure parameters to functions of the radiances. Emphasis is on mass-structure parameters compatible with the structure model which forms the basis at the Fleet Numerical Weather Central. GRA

N73-24502# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
ARCTIC INSTRUMENTATION CONSIDERATION Final Report on Test Operations Procedure
26 Jul. 1972 10 p refs
(AMCR Proj. 310-6)
(AD-758170; TOP-1-004) Avail: NTIS CSCL 14/5

The document provides background information relative to problems associated with instrumentation required for Arctic testing, discusses general environmental effects, equipment safeguards, data accuracy, and human factors provides procedures for maintenance of batteries and preparation of photographic equipment for Arctic use, and is applicable to all instrumentation used under Arctic conditions. Author (GRA)

N73-24503# Army Foreign Science and Technology Center, Charlottesville, Va.
A MULTIPLE-ROD PYRAMID AS A CYCLIC SUSPENSION FOR A PARABOLIC RADIOTELESCOPE MIRROR
P. D. Kalachev 11 Jan. 1973 23 p refs Transl. into ENGLISH from Vop. Radioelek. (USSR), no. 11, 1969 p 29-41
(AD-757237; FSTC-HT-23-1469-72) Avail: NTIS CSCL 03/1

A multiple-support suspension for a fully rotatable, parabolic radiotelescope mirror, providing it with high mechanical rigidity in any position in space, can be realized by various construction designs. The layout can be accomplished in the form of intermediate supporting construction, in a system of mutually parallel and perpendicular supporting elements having two axes of symmetry in the plan. The scheme can be a system of mutually parallel supporting elements. For example, a multiple support suspension design can be carried out in the form of a supporting rod pyramid (cyclical plan), two rod pyramids or in the form of a combination of rod pyramid and intermediate support construction. Author (GRA)

N73-24504# Army Foreign Science and Technology Center, Charlottesville, Va.
EXCERPT FROM PILOTING AND NAVIGATIONAL DEVICES
S. D. Danich 8 Nov. 1972 91 p Transl. into ENGLISH of the publ. "Elektropribornaye Oborudovaniye Samolete AN-24 "Transport" USSR, 1971 263 p
(AD-758751; FSTC-HT-23-2165-72) Avail: NTIS CSCL 01/4

A detailed description and technical data are presented of the instrument panel equipment installed on an aircraft which is quite varied in its purpose, operating principle and design. The entire complex of this equipment is designed for piloting and navigation of the aircraft day and night, under simple and difficult weather conditions, at all latitudes in both hemispheres of the Earth, at all flying altitudes of the An-24 aircraft. Author (GRA)

N73-24505# Naval Training Equipment Center, Orlando, Fla.
DESIGN STUDY OF AN OPTICAL SYSTEM FOR ANNULAR IMAGERY
Gottfried R. Rosendahl and Wiley V. Dykes Mar. 1973 39 p refs
(AD-758637; NAVTRAEQUIPC-IH-216) Avail: NTIS CSCL 14/5

A design approach for an around-the-horizon imagery with elevations -60 degrees, -30 degrees from the horizon, or vice versa, has been studied in detail. It refers to a catadioptric system without beamsplitter serving as a camera as well as a projector lens. The first image has a diameter of 25 mm in conjunction with an F/2.5 speed, but it can be magnified by the help of a relais lens (not a subject of this study). Third-order aberrations have been sufficiently corrected with observation of proper passage of marginal rays to serve as a starter for fine-correction. The report includes all design details required for that purpose. Author (GRA)

N73-24506*# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
SPECIAL REPORT, CROSS CALIBRATION OF JHU TEST EQUIPMENT WITH GSFC VACUUM OPTICAL BENCH
William G. Fastie 12 Sep. 1972 12 p
(Contract NAS9-11528)
(NASA-CR-128628; T72-19577) Avail: NTIS HC $3.00 CSCL 14B

Tests were conducted to confirm the validity of the absolute calibrations which have been performed with the Apollo 17 ultraviolet spectrometer (UVS) in the calibration test equipment (CTE) which were constructed for that purpose. To accomplish this the prototype UV spectrometer SN/01 was retrofitted to be substantially identical to the qualification unit and to the two flight units. It was renamed the cross calibration unit (CCU). The instrument was first calibrated in the JHU calibration test equipment (CTE), then installed in the vacuum optical bench (VOB) at Goddard Space Flight Center and calibrated. The following day a second CTE calibration was conducted which provided substantially the same calibration values as were obtained on the first CTE calibration, and showed remarkably close agreement with the VOB calibration values at two of the wavelengths which were studied. The VOB results at the third wavelength (1216 A) indicate the CTE calibration at 1216 A is 15% too low. This apparent discrepancy is discussed and presents a very important result of the cross calibration effort. Author

N73-24024 Cambridge Univ. (England). Engineering Lab.
A NARROW-BAND SPECTRAL ANALYZER FOR RANDOM WAVEFORMS
D. S. Whitehead *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1231-1246 refs Previously issued as ARC-22120 (For availability see N73-24011 15-01)
(ARC-R/M-3259; ARC-22120)

N73-24104* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DESCRIPTION OF THE MICROBIAL ECOLOGY EVALUATION DEVICE, FLIGHT EQUIPMENT, AND GROUND TRANSPORTER
Charles E. Chassay and Gerald R. Taylor *In its* Proc. of the Microbial Response to Space Environ. Symp. May 1973 p 21-39 (For availability see N73-24102 15-04)
CSCL 06M

N73-24105* Northrop Services, Inc., Houston, Tex.
CUVETTE LOADING AND UNLOADING PROCEDURES
Carolyn Carmichael and Walter L. Ellis *In* NASA. Johnson Space Center Proc. of the Microbial Response to Space Environ. Symp. May 1973 p 41-48 (For availability see N73-24102 15-04)
CSCL 14B

N73-24112* Northrop Services, Inc., Houston, Tex.
THE USE OF FILM ACTINOMETRY IN LOW INTENSITY ULTRAVIOLET IRRADIATION MEASUREMENT
Richard A. Long *In* NASA. Johnson Space Center Proc. of the Microbial Response to Space Environ. Symp. May 1973 p 155-168 (For availability see N73-24102 15-04)
CSCL 14B

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N73-24507 National Lending Library for Science and Technology, Boston Spa (England).
APPARATUS FOR EXPERIMENTAL STUDY OF FRICTION IN MINIATURE BALL BEARINGS IN AGGRESSIVE GAS MEDIA
O. N. Kovyrshin 8 Feb. 1973 10 p Transl. into ENGLISH from Izv. Vyssh. Ucheb Zaved., Mashinostro. (Moscow), no. 7, 1971 p 51-56
(NLL-Risley-Tr-2565-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A mechano-optical apparatus for non-contact measurements of very low static and friction moments in miniature ball bearings is reported. The device uses an optical photoelectric system for oscillographing discrete successive variations of journal rotation angle in an agressive gas media. G.G.

N73-24508 National Lending Library for Science and Technology, Boston Spa (England).
THE SOLIDIFICATION OF FUSION WELDS AND ITS EFFECTS ON WELDABILITY
H. Granjon and M. Dadian 8 Feb. 1973 35 p refs Transl. into ENGLISH from Soudage Tech. Connexes (Paris), v. 26, no. 5/6, 1972 p 181-195
(NLL-T1780/GC/72-(9022.305)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

Essential features of the solidification of fusion welds are surveyed. Data cover rate of solidification, epitaxy, physico-chemical aspects of solidification, and fusion and solidification during displacement of the molten pool. E.H.W.

N73-24509 National Lending Library for Science and Technology, Boston Spa (England).
DIFFUSION OF OIL VAPOURS THROUGH CLEARANCE SEALS, CONDENSATION OF THE VAPOURS ON SURFACES, AND CREEPING OF OIL FILMS ALONG SURFACES
H. Bentlage 8 Feb. 1973 75 p Transl. into ENGLISH from DFVLR Report no. 0662
(NLL-Risley-Tr-2567-(9091.9F); DFVLR-0662) Avail: Natl. Lending Library, Boston Spa, Engl.: 7 NLL photocopy coupons

The loss of weight of special oil reservoirs, the absorption of oil vapors at selected surfaces, and the propagation of oil along surfaces have been investigated under conditions similar to those existing in space. The investigations relate to two oils that have been used successfully for the lubrication of antifriction bearings under vacuum conditions. Application to the lubrication of the antenna despin system of the probe Helios is described. The weight loss rates cannot be attributed to molecular flow in the clearances of the bearing housings and are presumably influenced by creeping of the oil over the clearance surface.
Author

N73-24510 National Lending Library for Science and Technology, Boston Spa (England).
RESULTS OF LUBRICATION OBTAINED WITH EPILAMES SUITABLE FOR A METHYLALKYL-POLYSILOXANE FLUID
M. Massin and P. Rota 8 Feb. 1973 11 p Transl. into ENGLISH from CETEHOR Rept. 20
(NLL-Risley-Tr-2547-(9091.9F); CETEHOR-20) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The characteristics of epilame lubricant pairs for possible use in horology are discussed. Recent progress in modifying the surface energy of the solids to enable lubrication to be logically analyzed is described. The subjects considered are: (1) the laws of lubricated friction, (2) lubrication regimes, (3) action of lubricated mechanical assembly, (4) role of epilamus in lubricated friction, and (5) methods and experimental apparatus for epilame-lubricant pairs. Author

N73-24511 National Lending Library for Science and Technology, Boston Spa (England).
VOLATILIZATION AND OXIDATION OF ELECTRODE METAL IN GAS-SHIELDED ARC WELDING
I. R. Patskevich and O. A. Rykov 1973 10 p refs Transl. into ENGLISH from Avtomat. Svarka (USSR), v. 8, 1972 p 15-18
(NLL-DRIC-TRANS-3005-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The quantity of electrode metal lost by volatilization and oxidation in arc welding was investigated experimentally. Electrode wire specimens were subjected to arcing for a specified time. Each specimen was weighed before and after fusion. Slag was removed from the electrode, and the amount of oxidized metal, and that lost by volatilization determined. It is concluded that: (1) The ratio of the quantity of volatized electrode metal to the quantity of the fused metal increases with increasing current and arcing time. (2) Increasing the heat conductivity and oxidizing potential of the shielding gas increases the volatization intensity. (3) The quantity of volatilized and oxidized metal increases with increasing gas consumption. (4) The bulk of losses of electrode metal constituents is due to volatization. F.O.S.

N73-24512 National Lending Library for Science and Technology, Boston Spa (England).
THEORY OF CENTRIFUGAL EXTRACTION
V. I. Sokolov Apr. 1973 12 p refs Transl. into ENGLISH from Zh. Tekhn. Fiz. (Leningrad), v. 18, no. 1, 1948 p 105-114
(NLL-RTS-7990) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.10; 4 NLL photocopy coupons

The theory and applications of centrifugal extraction are discussed. The centrifugal extraction process is described as taking place in a centrifugal force field to compact a disperse residue, the pores of which are completely filled by fluid. Mathematical models are developed to analyze the performance of the process under various conditions. Author

N73-24513* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PUMP FOR DELIVERING HEATED FLUIDS Patent
Eric E. Sabelman, inventor (to NASA) Issued 8 May 1973 7 p Filed 2 Mar. 1971 Supersedes N72-32498 (10 - 23, p 3098) Sponsored by NASA
(NASA-Case-NPO-11417; US-Patent-3,732,040; US-Patent-Appl-SN-120241; US-Patent-Class-417-391; US-Patent-Class-60-25) Avail: US Patent Office CSCL 13I

A thermomechanical pump particularly suited for use in pumping a warming fluid obtained from an RTG (Radioisotope Thermal Generator) through science and flight instrumentation aboard operative spacecraft is described. The invention is characterized by a pair of operatively related cylinders, each including a reciprocating piston head dividing the cylinder into a pressure chamber confining therein a vaporizable fluid, and a pumping chamber for propelling the warming fluid, and a fluid delivery circuit for alternately delivering the warming fluid from the RTG through the pressure chamber of one cylinder to the pumping chamber of the other cylinder, whereby the vaporizable fluid within the pair of pressure chambers alternately is vaporized and condensed for driving the associated pistons in pumping and intake strokes. Official Gazette of the U.S. Patent Office

N73-24514*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NEW GENERALIZED RHEOLOGICAL MODEL FOR LUBRICATION OF A BALL SPINNING IN A NONCONFORMING GROOVE
Charles W. Allen, Dennis P. Townsend, and Erwin V. Zaretsky Washington May 1973 22 p refs
(NASA-TN-D-7280; E-7256) Avail: NTIS HC $3.00 CSCL 11H

The elastohydrodynamic theory for predicting the spinning friction of a ball in a nonconforming groove was modified to incorporate a rheological model. The rheological model is based on the exponential pressure viscosity relation for low shear stresses, but at high shear rates and pressures, the relation is altered to one in which the shear stress is porportional to the normal stress. The model was fitted to experimental spinning torques for four different lubricants: a synthetic paraffinic lubricant, di-2-ethylhexyl sebacate, a super-refined naphthenic mineral oil,

and a polyphenyl ether (5P4E). Good agreement between the model and experiment was found. Author

N73-24515*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
DETECTION OF LACK OF FUSION USING OPAQUE ADDITIVES, PHASE 2 Report for 1 Nov. 1972 - 30 Apr. 1973
J. L. Cook May 1973 50 p refs
(Contract NAS8-28708)
(NASA-CR-124251; MDC-G4530) Avail: NTIS HC $4.50 CSCL 14D

Plasma-sprayed copper coatings were developed to protect the aluminum surfaces of spacecraft structures from oxidation, as well as to provide a means of reliable nondestructive X-ray inspection of possible incomplete weldment penetration. Sixty day storage tests of coated aluminum samples indicated the promise of long-term oxidation protection, but revealed no advantage in detecting penetration defects. Delta-scan techniques were used, and peen plating as a means of applying copper to the aluminum surface was investigated. J.M.M.

N73-24516*# Rocketdyne, Canoga Park, Calif.
HIGH-PERFORMANCE SPACE SHUTTLE AUXILIARY PROPELLANT VALVE SYSTEM
G. M. Smith Jun. 1973 331 p refs
(Contract NAS3-14350)
(NASA-CR-120976; R-9078) Avail: NTIS HC $18.75 CSCL 13K

Several potential valve closures for the space shuttle auxiliary propulsion system (SS/APS) were investigated analytically and experimentally in a modeling program. The most promising of these were analyzed and experimentally evaluated in a full-size functional valve test fixture of novel design. The engineering investigations conducted for both model and scale evaluations of the SS/APS valve closures and functional valve fixture are described. Preliminary designs, laboratory tests, and overall valve test fixture designs are presented, and a final recommended flightweight SS/APS valve design is presented. Author

N73-24517*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HOT HARDNESS CHARACTERISTICS OF AUSFORMED AISI M-50, MATRIX 2, WD-65, MODIFIED AISI 440-C, AND SUPER NITRALLOY
James L. Chevalier, Marshall W. Dietrich, and Erwin V. Zaretsky Washington May 1973 15 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland
(NASA-TN-D-7244; E-7091) Avail: NTIS HC $3.00 CSCL 11F

Short-term hot hardness studies were performed with ausformed AISI M-50, Matrix 2, WD-65, modified AISI 440-C (14-4-1) and case hardened Super Nitralloy. Hardness levels of each material were measured at elevated temperatures in an electric furnace with a low oxygen environment. Test temperatures ranged from 294 to 877 K. The hot hardness characteristics of the ausformed AISI-M-50, Matrix 2 WD-65, and modified AISI 440-C were the same as those determined for high-speed tool steels. Hot hardness for these steels can be predicted within one point Rockwell C. The hot hardness characteristics of both the case and core of Super Nitralloy were superior to AISI 52100 but inferior to the high-speed tool steels. The short-term Rockwell C hardness at temperature for the Super Nitralloy material between 294 and 769 K can be predicted within one point Rockwell C hardness. Author

N73-24518*# Atomics International, Canoga Park, Calif.
THERMOELECTRIC PUMP PERFORMANCE ANALYSIS COMPUTER CODE SNAP Program
J. L. Johnson 11 Jun. 1973 24 p refs
(NASA Order C-21029-C; Contract AT(04-3)-701)
(NASA-CR-121204; AI-AEC-13095; C-926) Avail: NTIS HC $3.25 CSCL 13K

A computer program is presented that was used to analyze and design dual-throat electromagnetic dc conduction pumps for the 5-kwe ZrH reactor thermoelectric system. In addition to a listing of the code and corresponding identification of symbols, the bases for this analytical model are provided. Author

N73-24519# Bureau of Mines, Salt Lake City, Utah. Metallurgy Research Center.
PHYSICAL ASPECTS OF COPPER CEMENTATION ON IRON
Walter W. Fisher and Rees D. Groves 1973 12 p refs
(BM-RI-7761) Avail: NTIS HC $3.00

A study of copper cementation on iron was initiated to determine the effect that deposited copper has upon subsequent cementation. A microscopic investigation of cementation on an iron surface showed that cupric ion precipitates predominately on a growing copper deposit attached to the iron surface. A kinetic study of the cementation process in a revolving drum showed that the cementation rate is enhanced by the copper deposit attached to the iron surface and by the discrete copper particles of a cement copper slurry. The kinetic study also indicated that the character of the deposit is affected by the major anion in the solution. The cementation process is visualized to occur as a series of electrochemical cells in which cupric is visualized to copper dendrites attached to the iron surface. Author

N73-24520*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SCANNING ELECTRON MICROSCOPE STUDY OF POLYTETRAFLUOROETHYLENE SLIDING ON ALUMINUM SINGLE CRYSTALS
William A. Brainard and Donald H. Buckley Washington Jun. 1973 16 p refs
(NASA-TN-D-7321; E-7398) Avail: NTIS HC $3.00 CSCL 20B

Friction experiments were conducted in air with polytetrafluoroethylene (PTFE) sliding on aluminum single crystals. Mechanical scoring of the crystals with (110) and (100) orientations was observed with a single pass of the PTFE slider. No scoring was observed on the (111). The degree of scoring of the crystals is related to the hardness, with the hardest surface (111) showing no damage and the softest surface (110) showing the most severe scoring. Scoring is caused by work-hardened pieces of aluminum which, as a consequence of the adhesion between PTFE and aluminum, were pulled out of the bulk and became embedded in the PTFE polymer. Author

N73-24521*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF LOAD-LIFE RELATION WITH BALL BEARINGS AT 500 F
Richard J. Parker, Erwin V. Zaretsky, and Eric N. Bamberger (GE, Cincinnati) 1973 28 p refs Proposed for Presentation at the Joint Lubrication Conf., Atlanta, 16-18 Oct. 1973; sponsored Jointly by Am. Soc. of Lubrication Engr. and ASME
(NASA-TM-X-68240; E-6768) Avail: NTIS HC $3.50 CSCL 13I

A survey of the literature suggests that a stress-life exponent of approximately 12 is typical of vacuum-processed steels for ball bearings rather than the exponent of 9 which has been generally accepted by the bearing industry and bearing users. Tests run with vacuum-degassed AISI 52100 balls in the five-ball fatigue tester at four maximum Hertz stress levels in the range from 650,000 to 875,000 psi showed good agreement with the literature. However, tests run with consumable-electrode vacuum melted AISI M-50 steel angular-contact ball bearings at 500 F at three thrust loads did not show significant deviation from the accepted ninth power stress-life relation. Author

N73-24522*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BASIC PRINCIPLES OF VARIABLE SPEED DRIVES
Stuart H. Loewenthal 1973 15 p refs Presented at Variable Speed Transmission/Drive Seminar, Cleveland, 30 May 1973; sponsored by ASME Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland
(NASA-TM-X-68244; E-7494) Avail: NTIS HC $3.00 CSCL 13I

An understanding of the principles which govern variable speed drive operation is discussed for successful drive application. The fundamental factors of torque, speed ratio, and power as they relate to drive selection are discussed. The basic types of variable speed drives, their operating characteristics and their applications are also presented. Author

N73-24523*# Kanner (Leo) Associates, Redwood City, Calif.
EFFECT OF CONTACT-SURFACE-ACTIVE VAPORS ON THE BEHAVIOR OF STEEL DURING SLIDING FRICTION
H. Vetz and J. Foehl Washington NASA Jun. 1973 16 p refs Transl. into ENGLISH from Schmiertechnik Tribologie (Duesseldorf), no. 5, 1971 p 183-186 and 188
(Contract NASw-2481)
(NASA-TT-F-14935) Avail: NTIS HC $3.00 CSCL 11H

Wear tests were made on a vacuum wear test apparatus, with soft steel on soft steel specimens without lubrication. Controlled amounts of cyclohexane, H2O, and acetone vapor were introduced and weight loss determinations were made periodically. With increasing vapor concentration, the wear rate in the presence of water vapor increased steadily, whereas in the presence of cyclohexane and acetone a maximum wear rate was reached at low concentrations and then fell off. With cyclohexane the maximum reached was much lower than with acetone. In the case of acetone some bright spots were formed which lowered the wear rate even more. The tests indicated the importance of controlling the surrounding atmosphere when making wear tests. Author

N73-24524# National Aeronautical Lab., Bangalore (India).
TANGENT MILLING AND SPLINE APPROXIMATION TECHNIQUES IN MODEL MAKING
R. Sankar and S. Janardhan Apr. 1971 47 p
(NAL-TN-33) Avail: NTIS HC $4.50

Wings whose surfaces are developable, were milled on a jig-borer at the National Aeronautical Laboratory, Bangalore, employing tangential milling. In this process, the wing cross section is approximated by a polygon which can be smoothened by hand-finish. The polygonal approximation itself is such that each side of the polygon is a tangent to the aerofoil. The aerofoil is defined by a finite set of points got from experiments or otherwise. These points are joined smoothly by using spline approximation to achieve continuity of first and second derivatives. The splines and the settings of the jig-borer (for tangential milling) were obtained on the NAL Sirius computer. Each setting of the jig-borer consists of the cutter-height and two turnings of the turn-table, one about the latter's axis and the other about a fixed horizontal axis, so that the tangent plane coincides with the plane of milling. The two angles of rotation and the cutter-height depend upon the wing geometry besides some of the machine parameters. Author

N73-24525*# Aerojet Nuclear Systems Co., Azusa, Calif.
PREMIUM QUALITY 5A1-2.5 Sn ELI TITANIUM PRODUCTION Final Report
P. P. Dessau and C. L. Harris May 1972 439 p refs Sponsored by NASA
(Proj. 121)
(NASA-CR-132227; N8300R:72-103) Avail: NTIS HC $24.00 CSCL 13H

Preliminary design and reliability analysis conducted on the turbopump for the NERVA 75,000 full flow cycle engine, indicated that the turbopump bearings were the most critical turbopump parts in meeting the 10 hour life at the required turbopump reliability of .99978. The analysis revealed that significant reductions (approximately a factor of 3.25) in bearing loads would be achieved by fabricating the rotating parts from titanium in lieu of A286 or 718. This is basically due to the difference in density of the materials and the resulting mass effect on the location of the first and second stick mode critical speeds. For the selected rotor configuration, the lighter material has a first critical speed at approximately 36,000 rpm, while that of the heavier material has a first critical at approximately 27, 000 rpm. As the operating range of the turbopump is from 0 to 30,000 rpm, the heavier material would have a stick mode critical in the operating range. Author

N73-24526*# Aerojet-General Corp., Sacramento, Calif.
BYPASS CONTROL VALVE SEAL AND BEARING LIFE CYCLE TEST REPORT
A. V. Lundback Apr. 1972 51 p Sponsored by NASA Original contains color illustrations
(Proj. 122)
(NASA-CR-132226) Avail: NTIS HC $4.75 CSCL 13I

The operating characteristics of a bypass control valve seal and bearing life cycle tests are reported. Data from the initial assembly, leak, torque, and deflection tests are included along with the cycle life test results and conclusions. The equipment involved was to be used in the nuclear engine for the rocket vehicles program. Author

N73-24527*# Aerojet-General Corp., Sacramento, Calif.
STRESS RELAXATION OF HIGH STRENGTH A-286 BOLTS IN SIMULATED STORAGE AT ROOM TEMPERATURE
R. C. Sampson 21 Apr. 1972 45 p
(NASA-CR-132218) Avail: NTIS HC $4.25 CSCL 13I

It was concluded that thermally activated relaxation of the type customarily encountered at high temperatures was not expected to occur at the low temperatures where long time NERVA storage conditions will prevail. Instances where relaxation occurred by a different mechanism at such moderate temperatures were also reported. Twelve simulated bolted flange test specimens were prepared. Parameters that were varied among the twelve specimens were the flange material, the bolt shank diameter, and the bolt loading in terms of percent of yield strength. Author

N73-24528*# Aerojet-General Corp., Sacramento, Calif.
NERVA TURBOPUMP BEARING RETAINER FABRICATION ON NONMETALLIC RETAINER
J. B. Accinelli 4 Apr. 1972 28 p ref
(NASA-CR-132217) Avail: NTIS HC $3.50 CSCL 13I

The need for a low-wear, lightweight, high strength bearing retainer material with a radiation degradation threshold of 10 to the 9th power rads (C) prompted development of nonmetallic reinforced polymers of the following types: (1) polybenzimidazole, (2) polyimide, and (3) polyquinoxaline. Retainers were machined from tubular laminates (billets), including reinforcement by either glass or graphite fabric or filament. Fabrication of billets involves hot preimpregnation of the reinforcement fabric or filament with polymer followed by wrapping this prepreg over a heated mandrel to form a tube with the required thickness and length. Author

N73-24529*# Aerojet-General Corp., Sacramento, Calif.
STRUCTURAL EVALUATION OF MARMAN V-BAND COUPLING AND FLANGE WITH CONOSEAL GASKET Engineering Operations Report
J. H. Oates Jun. 1972 49 p refs Sponsored by NASA
(Proj. 127-f)
(NASA-CR-132219; N8600R:72-007) Avail: NTIS HC $4.50 CSCL 13E

Results are described of a development test program directed at evaluating the structural capabilities of the Marman V-band coupling and flange with conoseal gasket. The intended end use was for the 75K NERVA flight engine propellant lines. Of major importance in the structural evaluation was the ability to predict stresses throughout the assembly for a variety of loading conditions. Computer finite element analysis was used to predict these stresses but, for the subject configuration, large uncertainties were introduced in modeling the complex geometry and boundary conditions. The purpose of the structural tests was to obtain actual stresses and deflections for correlation with, and updating of the finite element model. Results of the incomplete test program are inconclusive with respect to determining suitability for use on the NERVA engine. Author

N73-24530*# Aerojet-General Corp., Sacramento, Calif.
LH2 PUMP COMPONENT DEVELOPMENT TESTING IN THE ELECTRIC PUMP ROOM AT TEST CELL C INDUCER NO. 1 Final Report
F. X. Andrews, J. J. Brunner, K. G. Kirk, J. P. Mathews, and T. Nishioka May 1972 400 p
(NASA-CR-132232; N8300R:72-101) Avail: NTIS HC $22.00 CSCL 13K

The characteristics of a turbine pump for use with the nuclear engine for rocket vehicles are discussed. It was determined that the pump will be a two stage centrifugal pump with both stages having backswept impellers and an inducer upstream of the first stage impeller. The test program provided demonstration of the ability of the selected design to meet the imposed requirements. Author

N73-24531*# Aerojet Nuclear Systems Co., Azusa, Calif.
DESIGN AND DEVELOPMENT OF LH2 COOLED ROLLING ELEMENT RADIAL BEARINGS FOR THE NERVA ENGINE TURBOPUMP. VOLUME 3: PHASE 2: TESTS ON BUILD-UPS 16, 17, AND 18 AT NRDS, JACKASS FLATS, NEVADA, DECEMBER 1971 - MARCH 1972
J. B. Accinelli, D. A. Koch, and F. Reuter May 1972 328 p Sponsored by NASA
(Proj. 121)
(NASA-CR-132229; N8300R:72-105) Avail: NTIS HC $18.50 CSCL 13I

The use of liquid hydrogen to cool the rolling element radial bearings in the nuclear engine for rocket vehicles is discussed. The fifteen hour service life goal was obtained during the tests. The increase in bearing life was also considered to be produced by: (1) improvements in bearing material, (2) bearing retainer configuration and manufacturing changes, and (3) better control of operating parameters. Author

N73-24532*# Engineering, Inc., Torrance, Calif.
DEVELOPMENT OF CONTINUOUS FORMING CURING TECHNIQUES FOR PRODUCTION OF CIRCULAR STRUCTURAL COMPOSITE SHAPES FOR SPACE VEHICLE APPLICATION Final Report
E. E. Hardesty 14 Dec. 1972 48 p refs
(Contract NAS8-26900)
(NASA-CR-124253) Avail: NTIS HC $4.50 CSCL 13H

The fabrication of full-size structural rings from composite materials is described. Results of glass/epoxy and graphite/epoxy hat stringer sections prepared by pultrusion are discussed. F.O.S.

N73-24533# Kernforschungszentrum, Karlsruhe (West Germany). Lab. fuer Isotopentechnik.
WEAR BEHAVIOUR AND LOAD CAPACITY OF JOURNAL BEARINGS IN THE TRANSITION RANGE FROM FULL TO BOUNDARY LUBRICATION (INVESTIGATIONS BY MEANS OF RADIOISOTOPES) Ph. D. Thesis - Karlsruhe Univ.
Gustav Katzenmeier Feb. 1972 134 p refs In GERMAN; ENGLISH summary
(KFK-1569) Avail: AEC Depository Libraries

The calculation of hydrodynamically lubricated journal bearings becomes uncertain as the shaft and the bush approach the zone of mixed friction. To obtain a precise knowledge of the limit of load capacity, experiments must be performed. Wear measurement with the help of radioisotopes is a very sensitive means of assessing the limits of safe operation free from wear. Preliminary investigations using gamma-spectrometry revealed that all bearing materials containing lead - this applies to most of the commercially available bearings - can be activated by deuteron bombardment in such a manner that the bearinggs can be subjected to single-and multi-component wear measurements by existing measuring techniques. Author (NSA)

N73-24534# Oak Ridge Y-12 Plant, Tenn.
APPLICATIONS OF AIR BEARINGS
P. J. Steger Dec. 1972 19 p refs Presented at Precision Machining and Gaging Conf., Oak Ridge, Tenn., 14 Nov. 1972
(Contract W-7405-eng-26)
(Y-DA-4834; Conf-721130-28) Avail: NTIS

The design, applications, and operating experience of air bearings are reviewed. The advantages and disadvantages in the use of air bearings are enumerated along with their fabrication requirements. Design parameters for air bearing components are discussed with emphasis placed on machine tool and inspection machine applications. D.L.G.

N73-24535# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
INVESTIGATIONS ON ELECTROHYDRAULIC DIRECTIONAL VALVES WITH FLUIDIC BALL ELEMENTS Ph.D. Thesis - Brunswick Univ. [UNTERSUCHUNGEN AN ELEKTROHYDRAULISCHEN SCHALTVENTILEN MIT FLUIDISCHEN KUGELELEMENTEN]
Karl-Heinz Post 17 Jan. 1973 149 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-35) Avail: NTIS HC $9.50; DFVLR Porz-Wahn: 25,50 DM

Fluidically controlled ball elements have advantages in respect to functional reliability, life, leakproof application at high pressures, and high switching speed. They are suitable for hydraulic logic circuits and multistage directional valves. A basic study of the flow and flow forces in ball valves was made. The switching conditions, adaption of connected elements, and measured operating times of fluidic ball elements are given. To achieve extremely short switching times in multistage solenoid operated ball valves, the dynamic behavior of electromagnetic drives was investigated. The practical application of this new valve technology was demonstrated in fabricated prototypes of two-stage electrohydraulic ball valves. Author (ESRO)

N73-24536# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Munich (West Germany). Inst. fuer Flugtreib- und Schmierstoffe.
A STUDY OF THE ANTIWEAR EFFECTIVENESS OF CARBOXYLIC ACIDS IN SYNTHETIC LUBRICANTS ON ESTER BASIS [UNTERSUCHUNGEN ZUR ABRIEBVERMINDERNDEN WIRKUNG VON LARBONSAEUREN IN SYNTHETISCHEN SCHMIEROELEN AUF ESTERBASIS]
Guenter Spengler, Kenneth A. Davis, and Rudolf Woerle 2 Feb. 1973 26 p refs In GERMAN; ENGLISH summary Prepared in cooperation with Tech. Univ., Munich
(DLR-FB-73-43) Avail: NTIS HC $3.50; DFVLR Porz-Wahn: 10 DM

Antiwear effectiveness investigations of carboxylic acids with defined chemical structure in synthetic lubricants on ester basis were made using the friction and wear apparatus developed by Wintershall/Baist. The dependence of antiwear effectiveness on the structure characteristics of carboxylic acids, such as length of chain and degree of saturation, are discussed. By combining carboxylic acids with phosphorus containing EP-additives, effectiveness gaps, as they occur with tricresyl phosphate over certain load ranges, can be covered. Author (ESRO)

N73-24537# Mechanical Technology, Inc., Latham, N.Y.
HIGH PERFORMANCE BEARING STUDY Technical Report, 5 Mar. 1971 - 5 Jun. 1972
Warren D. Waldron and William E. Young (Pratt and Whitney Aircraft, West Palm Beach, Fla.) Wright-Patterson AFB, Ohio AFAPL 15 Jul. 1972 206 p refs
(Contract F33615-71-C-1382; AF Proj. 3048)
(AD-757869; MTI-72TR26; AFAPL-TR-72-63) Avail: NTIS CSCL 13/9

A feasibility investigation was performed to identify the probable advantages, problem areas, and the degree of feasibility of applying air lubricated bearings to an advanced class of U.S. Air Force complex-cycle aircraft engines. Three P-WA engines incorporating wraparound ramjets for high-Mach number, high-altitude operation were used as vehicles for the evaluation. No significant engine performance, size or weight penalty associated with air-lubricated bearings when compared to conventional oil-lubricated, rolling-element bearings was found. Hydrodynamic type bearings were found to have better load capacity characteristics than hydrostatic or hybrid types. New methods of cooling both the journal and thrust bearing were conceived which reduced the quantity of cooling air required from the engine. (Author Modified Abstract) GRA

N73-24538# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LUMINESCENT AND COLOR FLAW DETECTION, CHAPTER 7 AND BIBLIOGRAPHY
A. V. Karyakin and A. S. Borovikov 13 Mar. 1973 27 p refs Transl. into ENGLISH from the publ. "Lyuminestsentnaya i Tsvetnaya Defektoskop, ya" USSR, 1972 p 184-188 and 233-238
(AD-758047; FTD-HT-23-30-73) Avail: NTIS CSCL 14/2

The report presents a comparison of the effectiveness of the luminescence-color, electro-induction, and internal friction methods to nondestructively determine flaws in gas turbine blades. GRA

N73-24539# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.

EFFECT OF BLADE THICKNESS ON SHEAR STRENGTH
Albert E. Simkins 26 Jan. 1973 26 p
(AD-757997; NADC-73023-30) Avail: NTIS CSCL 13/5

In order to evaluate the various fixtures used in determining the shear strength of fasteners, a round robin test was conducted. It was found that single shear tests yield slightly higher shear strengths. Author (GRA)

N73-24540# Boeing Co., Philadelphia, Pa. Vertol Div.
TEST RESULTS REPORT AND TECHNOLOGY DEVELOPMENT REPORT HLH/ATC COMPLIANT ROLLER BEARING DEVELOPMENT PROGRAM Final Report
Joseph W. Lenski, Jr. Nov. 1972 138 p refs
(Contract DAAJO1-71-C-0840(P40); DA Proj. 1X1-6303-D-156)
(AD-755535; USAAMRDL-TR-72-62) Avail: NTIS CSCL 13/9

The report presents the results of effort conducted between August 1971 and March 1972 to define criteria and to design, fabricate, and test compliant rollers to obtain the optimum detail roller profile for use in the HLH rotor transmission second-stage planetary system. Tests were performed between flat plates under HLH loading and misalignment conditions. Technical inspection and evaluation of the test results will be used for selecting the optimum compliant roller configuration for the HLH rotor transmission second-stage planetary system. Author (GRA)

N73-24541# Naval Intelligence Support Center, Washington, D.C. Translation Div.
IMPROVING THE SCREWABILITY OF TITANIUM BOLTS WITH NUTS MADE OF VARIOUS MATERIALS
Yu. S. Danilov and E. N. Novikova 19 Mar. 1972 10 p refs Transl. into ENGLISH from Vestn. Mashinostr. (Moscow), no. 7, 1968 p 27-30
(AD-758037; NISC-TRANS-3421) Avail: NTIS CSCL 13/5

The investigation concludes that nuts made of 1 Kh18 N9 steel, nuts made of OT4 alloy oxidized at 700 and 800C, and nuts made of VT3-1 alloy oxidized at 800C are most suitable for use in connections with VT14 and VT16 titanium alloy bolts. GRA

N73-24542# Mechanical Technology, Inc., Latham, N.Y.
STATISTICAL EVALUATION OF THE LUBRICATED SHOT PEENING PROCESS Technical Report, 15 Sep. 1971 - 15 Apr. 1972
Pradeep K. Gupta Oct. 1972 60 p refs
(Contract F33615-72-C-1209)
(AD-758624; MTI-72TR46; AFML-TR-72-259) Avail: NTIS CSCL 13/8

To quantitatively assess the differences in fatigue life results, between conventional and fluid coated or lubricated shot peening with 7075-T73 Aluminum and 6Al-4V Titanium, under identical peening intensities, a fatigue test program was carried out using cantilever type test equipment. Tests were run under low-medium cycle conditions. Even though the statistical test for the differences in mean fatigue lives for the two processes showed differences in means at a significance level of 0.10, (or less in some cases) the estimated strength of statistical association was much smaller than that which could be detected by the amount of data obtained to draw any significant conclusion. (Author Modified Abstract) GRA

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N73-24543 Rensselaer Polytechnic Inst., Troy, N.Y.
LIGHT EMISSION AND EXCESS CURRENT ASSOCIATED WITH CARRIER GENERATION IN GUNN DOMAINS Ph.D. Thesis
Kenneth Edward Beilstein, Jr. 1972 261 p
Avail: Univ. Microfilms Order No. 72-30198

Carrier generation by impact ionization in the high field regions of Gunn domains was investigated. A model of the Gunn domain with impact ionization was developed from which the generation rate of excess carriers is determined. Knowing this generation rate of excess carriers, the nonlinear dynamic resistance (excess current) is predicted as well as the maximum available light power. From these parameters a pump efficiency for light generation is determined. Experimental measurements of the nonlinear dynamic resistance are obtained which correspond to the predicted nonlinear resistance. The predicted nonlinear resistances compare well with experimental results and indicate that the predicted generation rate of excess carriers is reasonable. As a consequence, the equivalent quantity, the calculated maximum available light power, is assumed roughly correct so that it can be used in the determination of the quantum efficiencies. Dissert. Abstr.

N73-24544 Polytechnic Inst. of Brooklyn, N.Y.
THE COPPER VAPOR LASER Ph.D. Thesis
Robert John Louis Chimenti 1972 141 p refs
Avail: Univ. Microfilms Order No. 72-28216

The results of an investigation of the copper vapor laser are reported. A portion of the work was devoted to an investigation of the relaxation of the D-2 metastable lower laser levels and properties of the Cu vapor-inert gas plasma. The remaining portion consists of the determination of the output properties of the laser under different operating conditions and the utilization of the high gain to demonstrate a spatially coherent, superradiant generator. Two high temperature Cu vapor lasers were used in the study. Measurements of the decay rates of the D-2 metastable lower laser levels in 2 torr of Ar were made by an absorption technique. Dissert. Abstr.

N73-24545 Rochester Univ., N.Y.
A NEODYMIUM:GLASS LASER SYSTEM FOR PRODUCING HIGH POWER SUBNANOSECOND LIGHT PULSES Ph.D. Thesis
George Dube 1972 182 p
Avail: Univ. Microfilms Order No. 72-28745

A description is given of the design, construction, and performance of a laser system created to generate laser produced plasmas for research on controlled thermonuclear fusion. Plasma physics theory indicates that a pulse duration of approximately 100 picoseconds is required. Several methods for producing these pulses are considered and the construction and performance of a laser system employing one of these methods is described. This system consists of a mode-locked Nd:glass oscillator, high speed shutters, isolators, pulse shapers, beam expanders, and as many as five Nd:glass amplifiers. The design and performance of each of these elements are described. The effects of various cavity configurations and operating conditions are studied. It is shown that previous subnanosecond pulse detection methods are inadequate for some purposes and a new method which partially overcomes these inadequacies is described. Theoretical and experimental limitations of this system, and high power systems in general, are considered. Dissert. Abstr.

N73-24546 Rochester Univ., N.Y.
TRANSVERSE MODE-LOCKING IN THE ARGON-ION LASER Ph.D. Thesis
Peter Eugene Nebolsine 1972 125 p
Avail: Univ. Microfilm Order No. 72-28779

A theoretical and experimental study of the output beams from large-bore argon-ion lasers was conducted. The objective of the study was to induce transverse mode-locking in a large-bore laser and to establish the suitability of this mode of operation for producing a high resolution scanning beam. An intra-cavity electro-optic beam deflector was used to induce transverse mode-locking. In spite of strong mode competition inherent in the argon-ion laser, single set of transverse modes fully saturated the gain profile under these conditions. A scanning beam resulted from locking the transverse modes of the laser. The resolution of the beam was considerably lower than predicted for this kind of operation. This discrepancy appears to be caused by the poor (measured) optical quality of the intracavity modulator. The design of an appropriate optical cavity for use in this application was considered, and an analysis of the coupling of transverse modes by an intra-cavity beam deflector was made. Dissert. Abstr.

N73-24547 Arizona Univ., Tucson.
DIRECT LASER INDUCED EXCITATION OF THE SECOND

VIBRATIONAL LEVEL OF HF Ph.D. Thesis
Melvin Joseph Bina 1972 116 p
Avail: Univ. Microfilms Order No. 72-30381

The relaxation time of the second vibrational level of gaseous hydrogen fluoride (HF) was measured by means of direct laser induced excitation. The results presented represent the first reported instance of direct overtone excitation of molecular vibration-rotation energy levels. The successful result was based on the development of a solid state laser, neodymium doped yttrium orthoaluminate, that could be temperature turned to the proper wavelength to be resonant with the (V = 0 approaches 2)P(6) level of HF. The laser beam was directed into an HF cell that operated in conjunction with a gas flow system that supplied pure mixtures of HF in argon at approximate partial pressures of HF of 1 torr. Following laser excitation, the infrared fluorescence from the vibrationally excited HF molecules in the cell was monitored by means of an InSb detector operated at liquid nitrogen temperatures. Dissert. Abstr.

N73-24548 Polytechnic Inst. of Brooklyn, N.Y.
AN INVESTIGATION OF THE MODULATION OF AN ELECTRON BEAM BY A LASER Ph.D. Thesis
Laurence S. Silverstein 1972 316 p
Avail: Univ. Microfilms Order No. 72-28287

An investigation of the modulation of an electron beam by a laser beam in a thin film with the subsequent production of light when the electron beam strikes a nonfluorescent screen was conducted. A 37 KeV, 1 microampere electron beam, with an energy spread of 1 electron volt was diffracted by a thin film of polycrystalline Al2O3 or TiO2 (700 to 1000 Angstroms thick), or a monocrystalline mica (less than 700 Angstroms thick). The beam from a pulsed copper-vapor laser with a peak power of 10 watts was focussed to obtain an intersection with the electron beam in the film. No evidence of photons due to electron modulation at the level of 0.5 times 10 to the minus 10th power watts was detected. Dissert. Abstr.

N73-24549*# Hughes Research Labs., Malibu, Calif.
LASER SPACE COMMUNICATION EXPERIMENT: MODULATOR TECHNOLOGY
F. E. Goodwin Feb. 1973 213 p refs
(Contract NAS1-10894)
(NASA-CR-112321) Avail: NTIS HC $12.75 CSCL 20E

Results are presented of a contractual program to develop the modulator technology necessary for a 10.6 micron laser communication system using cadmium telluride as the modulator material. The program consisted of the following tasks: (1) The growth of cadmium telluride crystals of sufficient size and purity and with the necessary optical properties for use as laser modulator rods. (2) Develop a low loss antireflection coating for the cadmium telluride rods. (3) Design and build a modulator capable of 300 MHz modulation. (4) Develop a modulator driver capable of a data rate of 300 MBits/sec, 12 W rms output power, and 40 percent efficiency. (5) Assemble and test the modulator system. All design goals were met and the system was built and tested. Author

N73-24550# Oklahoma State Univ., Stillwater. Dept. of Physics.
GROWTH AND HARDENING OF ALKALI HALIDES FOR USE IN INFRARED LASER WINDOWS Semiannual Technical Report
W. A. Sibley, C. T. Butler, J. R. Hopkins, J. J. Martin, and J. A. Miller 31 Oct. 1972 17 p refs
(Contract F19628-72-C-0306; ARPA Order 2055)
(AD-757893; AFCRL-TR-73-0069) Avail: NTIS CSCL 20/6

Intercomparisons between flow stress, microhardness, and rosette size measurements for purified KCl single crystals, KCl:Ca, KCl:Sr, and KCl(x)Br(l-x) mixed single crystals are made. A good correlation between the flow stress and inverse of the length of the dislocation rosette size was found for this crystal system. These results, along with the results of other investigators show that once a rosette size versus flow stress calibration has been made for a particular crystal system, the rosette size becomes a useful, simple, nearly nondestructive technique for determining the flow stress of a crystal. Author (GRA)

N73-24551# United Aircraft Corp., East Hartford, Conn. Research Labs.
PICOSECOND LASER PULSES Semiannual Technical Report, 1 Aug. 1972 - 28 Feb. 1973
William H. Glenn 29 Mar. 1973 41 p refs
(Contract N00014-66-C-0344; ARPA Order 1806)
(AD-758059; UARL-M920479-39) Avail: NTIS CSCL 20/5

The report discusses the application of ultrafast laser pulses to high resolution imaging radar systems. The principal results reported include the successful demonstration of a laboratory scale range Doppler radar, and a discussion of novel ultrafast data processing techniques. Author (GRA)

N73-24552# Informatics, Inc., Rockville, Md.
BIBLIOGRAPHY OF SOVIET LASER DEVELOPMENTS Quarterly Report, Oct. - Dec. 1972
Stuart G. Hibben 15 Feb. 1973 140 p refs
(Contract F44620-72-C-0053; ARPA Order 1622-3)
(AD-758259; AFOSR-73-0535TR; qr-10) Avail: NTIS CSCL 20/5

This is the Soviet Laser Bibliography for the fourth quarter of 1972 and is No. 10 in the series on Soviet laser developments. The coverage includes basic research on solid state, liquid and gas lasers; chemical lasers; u-v lasers; components; nonlinear optics, spectroscopy of laser materials; ultrashort pulse generation; crystal growing; and general laser theory. Laser applications are listed under biological effects; communications; computer technology; holography; instrumentation and measurement; materials processing; and plasma generation and diagnostics. Author (GRA)

N73-24553# Ohio State Univ., Columbus. Electroscience Lab.
LASER PROPAGATION TEMPORAL SPECTRA
G. W. Reinhardt and Stuart A. Collins, Jr. Feb. 1973 41 p refs
(Contract F30602-72-C-0305; ARPA Order 1279)
(AD-757915; ESL-3432-2; RADC-TR-73-66) Avail: NTIS CSCL 20/6

The research is aimed at providing theoretical support to the RADC Laser Propagation Program in the areas of atmospheric propagation phenomena and microturbulence statistics. The efforts in the report are in support of the experimental program being conducted at RADC. The phase difference temporal spectrum was evaluated for arbitrary orientation of the phase observation points in a plane perpendicular to the beam axis. The calculation was based on the method of spectral expansions and the Rytov approximation but the equations were rearranged to emphasize their relationship to the physical picture using a phase screen model. The calculation uses a generalized index of refraction spectrum which has arbitrary power law dependence in the inertial subrange and includes outer-scale effects. This generalization allows one to directly test phase difference spectra measurements to check the generally accepted kappa to the (-11/3) power dependence. The development also allows a direct evaluation of the outer-scale. GRA

N73-24554# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
LASER DAMAGE IN MATERIALS Semiannual Technical Report, 1 Aug. 1972 - 31 Jan. 1973
Albert Feldman, Deane Horowitz, and Roy M. Waxler Feb. 1973 52 p refs
(ARPA Order 2016)
(AD-757789; NBSIR-73-119) Avail: NTIS CSCL 20/5

The relative contributions of the Kerr, electrostrictive, and thermal effects to the self-focusing thresholds of borosilicate crown glass, fused silica, and dense flint glass have been estimated from an analysis of damage threshold data for linearly polarized and circularly polarized radiation. The measurements were made with a Nd glass laser operating in the TEMoo mode with a temporal pulse width of 25 nsec. Self-focusing data obtained with linearly polarized and circularly polarized radiation are presented for yttrium aluminum garnet (YAG) and five commercial Nd doped laser glasses. Self-focusing data obtained in dense flint glass with a longer focal length lens are also presented. An electro-optic shutter actuated by a laser triggered spark gap is discussed. Author (GRA)

N73-24555# McGill Univ., Montreal (Quebec). Dept. of Mechanical Engineering.

POPULATION INVERSION IN BLAST WAVES
John H. Lee, Tien D. Bui, and Romas Knystautas Dec. 1972 16 p refs
(Grant AF-AFOSR-1752-69; AF Proj. 9711)
(AD-757881; MERL-72-14; AFOSR-73-0498TR) Avail: NTIS CSCL 20/5

The present communication demonstrates that significant population inversion can be achieved in the flow structure behind a blast wave if the appropriate choice of the initial parameters is made. Typical numerical results are given for a cylindrical blast from a line source in a CO2-N2-He medium. The predicted peak population inversion levels are an order of magnitude better when compared with those achieved in the more conventional gasdynamic expansion systems using supersonic nozzles.
Author (GRA)

N73-24556# Martin Marietta Corp., Orlando, Fla.
ACOUSTO-OPTIC ISOLATOR (ACI) Interim Technical Report
Vincent J. Corcoran, William T. Smith, and James M. Martin 22 Oct. 1972 42 p refs
(Contract F30602-72-C-0475; ARPA Order 1279)
(AD-757914; OR-12329; RADC-TR-73-52) Avail: NTIS CSCL 20/6

The effort has examined the isolation capabilities and overall operational efficiency of employing an acousto-optical frequency translator for the purposes of suppressing optical feedback generated instabilities in a laser MOPA chain. The operating principle is based on decoupling optical feedback from sustained laser oscillation by frequency translating the feedback such that it falls outside the gain bandwidths of any of the CO transition lines. Current progress has demonstrated successful optical feedback isolation, but, has experienced spurious acoustical and RF induced heating of the frequency translator which has limited its overall efficiency to approximately 10 percent. Author (GRA)

N73-24557# GTE Labs., Inc., Waltham, Mass.
TUNABLE CW DYE LASERS Semiannual Technical Summary Report, 31 Jan. - 30 Jul. 1972
A. Lempicki, H. Samelson, and R. Alfano Feb. 1973 26 p refs
(Contract DAHC04-71-C-0012; DA Proj. 200-61102-B-11B)
(AD-757772; TR-73-840.1; AROD-9422-4-P) Avail: NTIS CSCL 20/5

The earlier work carried out under this contract has resulted in the construction and investigation of the properties of a CW dye laser. The device which has evolved from this work has shown remarkable stability, ruggedness and freedom from destructive failure over prolonged periods of time. Due to the discontinuity of the refractive index across these boundaries and the resulting etalon effect, the laser output consists of multiple lines. For some applications this is a highly desirable property, but when a single line output is required it does introduce problems. A method to suppress the extra lines is described. The transient response of the laser to a square pulse of excitation is explained and a preliminary analysis of the role played by detergents which are commonly added to dye solutions is discussed. GRA

N73-24558# Wisconsin Univ., Madison. Dept. of Chemistry.
THE FORMYL FLUORIDE PHOTOCHEMICAL LASER: PHOTOCHEMISTRY AND ENERGY CONTENT OF THE HF PHOTOELIMINATION PRODUCT
Daniel E. Klimer and Michael J. Berry Mar. 1973 16 p refs
(Contract N00014-67-A-0128-0022; NR Proj. 051-521)
(AD-757743; TR-1) Avail: NTIS CSCL 07/5

Photolysis (lambda = 1650A) of formyl fluoride (HFCO) leads to HF infrared laser emission. The energy content of the HF photoelimination primary product is only a small fraction (about 7%) of the available excess energy. Fluorine atoms may also be produced as primary photochemical products.
Author (GRA)

N73-24559# United Aircraft Corp., East Hartford, Conn. Research Labs.
INVESTIGATION OF THIN FILM MODULATOR FOR 10 MICRON LASERS Interim Technical Report, 25 Aug. 1972 - 25 Mar. 1973
P. K. Cheo 30 Mar. 1973 49 p refs
(Contract N00014-73-C-0087; ARPA Order 1806)
(AD-757792; UARL-M921513-2) Avail: NTIS CSCL 20/5

The objective of the program is to explore various techniques using GaAs epitaxial thin films as the active elements for electrooptic modulation of the 10.6 micrometer CO2 laser radiation. The advantages as well as the limiting factors concerning the use of thin films to perform phase and polarization modulation or switching of infrared laser radiation are investigated. The results of this program shall provide useful information concerning the possible use of GaAs thin films to replace bulk materials for electrooptic modulation of infrared laser radiation. Furthermore, results of this program may provide a guideline to the design of the master oscillator by taking the advantage of thin film modulator to yield the necessary wave envelope and bandwidth required for the high power pulsed CO2 laser imaging radar system.
GRA

N73-24560# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TIME RESPONSES OF RADIATION OF AN IODINE LASER WITH Q-FACTOR MODULATION
V. A. Dudkin and V. I. Malyshev 16 Mar. 1973 11 p refs Transl. into ENGLISH from Vysokomolekul. Soedin. (Moscow), no. 3, 1971 p 35-40
(AD-758625; FTD-MT-24-1729-72) Avail: NTIS CSCL 20/5

An analysis of the characteristics of an iodine laser with modulated Q-factor has been carried out in a number of works. However, very little attention was paid to the study of time responses of laser radiation in these works. Only the complexity of the time picture and the average duration of individual giant pulses were mentioned. In the report, experimental data are given from studies of time responses of radiation of an iodine laser with Q-factor modulation and their dependence on certain laser parameters. GRA

N73-24561# United Aircraft Corp., East Hartford, Conn.
MASTER OSCILLATOR TECHNIQUES FOR 10 MICRON RADAR Semiannual Technical Report, 25 Aug. 1972 - 25 Mar. 1973
A. Stein 31 Mar. 1973 28 p refs
(Contract N00014-73-C-0086)
(AD-758706; M921512-3) Avail: NTIS CSCL 20/5

A CO2 waveguide laser was operated with an intracavity electro-optic polarization modulator. Coupling modulation at 48 and 120 MHz was observed which represents a significant step towards the contract goal to investigate the feasibility of linear ramp frequency modulation (500 MHz in 300 microsec.) of a stable CO2 oscillator. This master oscillator is of interest for a high resolution optical radar application. GRA

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N73-24562 National Lending Library for Science and Technology, Boston Spa (England).
EFFECTS OF HOMOGENIZING ANNEALING ON THE TECHNOLOGICAL EFFECTIVENESS OF Kh25N16G7 STEEL SUBJECTED TO HOT TREATMENT
I. V. Doronin, V. A. Zverena, I. N. Melkuonov, T. V. Lisina, V. T. Loginov, V. V. Topilin, and A. F. Filippov [1973] 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), v. 11, 1972 p 143-144 In ENGLISH and RUSSIAN (NLL-M-21616-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effects of homogenizing annealing on the ductility of high strength steel are analyzed. Homogenizing annealing was conducted at 1150 C. During homogenization excess phases along the secondary grain boundaries are dissolved. The purpose of the annealing is to make the steel more capable of withstanding hot rolling or forging. Author

N73-24563 National Lending Library for Science and Technology, Boston Spa (England).
THE PHENOMENON OF CHANGE INTO A STRUCTURELESS LIQUID IN PURE METALS AND SEMICONDUCTORS
E. S. Filippov [1973] 21 p refs Transl. into ENGLISH from Iz. Vyssh. Ucheb. Zaved., Chern Met. (USSR), v. 11, 1972 p 122-127 In ENGLISH and RUSSIAN
(NLL-M-21614-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A phase change which takes place when molten metals, semiconductors, and alloys are heated to 700 to 900 C above melting is discussed. The temperature at which the phase change occurs is called the temperature of transition to statistical packing or transition to structureless liquid. The transformation is accompanied by an increase in volume and absorption of heat. The nature of the staged jump in density, the transition to statistical packing can be classified as either a first order or a second order phase change. Various parameters associated with the phase change are tabulated. Author

N73-24564 National Lending Library for Science and Technology, Boston Spa (England).
GAS PERMEABILITY OF HIGH POROSITY NICKEL POWDER METALLURGY PARTS
V. K. Solyakov, M. E. Shilovskaya, and A. G. Sokker 13 Mar. 1973 14 p refs Transl. into ENGLISH from Porosh. Met. (USSR), v. 12, no. 6, 1972 p 65-70 In ENGLISH and RUSSIAN
(NLL-LTI-746-1404-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The gas permeability of high porosity nickel powder metallurgy parts is discussed. Samples of materials were prepared by single pressing of composites of nickel powder and blowing agent (ammonium bicarbonate) with subsequent sintering of the semi-finished products in hydrogen at 700 C. The porous structure of the material was varied by using different nickel powders and different quantities of blowing agent. The gas permeability was determined on samples in the form of discs of 25 millimeter and 5 to 6 millimeter thickness. The technique for measuring the gas permeability is described. Author

N73-24565 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF MOLYBDENUM ON PROPERTIES OF HARD Ti-C-Ni COMPOSITE ALLOYS
G. V. Samsonov and G. T. Dzodziev 20 Dec. 1972 9 p refs Transl. into ENGLISH from Porosh. Met. (USSR), v. 12, no. 4, 1972 p 57-60 In ENGLISH and RUSSIAN
(NLL-LTI-746-1422-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

An effect was investigated of hard alloys Ti-C-Ni alloying with molybdenum within a wide concentration range on their structure and physicomechanical properties. It was established that optimal properties are obtained at 20% Mo by vol. in a bond; depending on the total content of the bond, bending strengths of the alloys changes from 105 to 180 kg/sq mm with hardness from 92 to 85 HRA respectively. Cutting wear resistance of the experimental alloys with a hardness of 92 HRA is as high as that of the standard alloy T15K6. Author

N73-24566 National Lending Library for Science and Technology, Boston Spa (England).
MAGNETIC PROPERTIES OF HIGHLY-DISPERSED IRON-COBALT-NICKEL ALLOY POWDERS
T. M. Shvets, L. Yu. Ivanova et al 13 Mar. 1973 12 p refs Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 7, Jul. 1972 p 71-75 In ENGLISH and RUSSIAN
(NLL-LTI-746-1419-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Eng.: 1 NLL photocopy coupon

The effect of electrolysis on the magnetic characteristics of highly dispersed iron-cobalt-nickel alloy powders is investigated. It was determined that as the electrolyte concentration is increased a greater quantity of polydomain particles appears, a phenomenon which is identified by a decrease in the value of the coefficient of relative residual induction. J.M.M.

N73-24567 National Lending Library for Science and Technology, Boston Spa (England).
NORMAL ANISOTROPY AND TEXTURE IN COLD-ROLLED LOW-CARBON STEEL
A. A. Vostrikov, V. P. Gubchevskii, and E. D. Nemkina [1973] 11 p refs Transl. into ENGLISH from Stal' (Moscow), v. 11, 1972 p 1029-1032
(NLL-M-21627-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A study has been made of the relation between texture development and normal anisotropy in cold-rolled, low-carbon steel using X-ray examination and measurement of the coefficient of normal plastic anisotropy during tensile tests. The observed changes in anisotropy can be accounted for by a change in the quantitative relationship of the crystal orientations parallel to the rolling plane depending on the sheet production parameters. Regression equations are derived for the dependence of anisotropy in the annealing temperature range of 400 to 900 C on the crystal structure intensity ratio. Author

N73-24568 National Lending Library for Science and Technology, Boston Spa (England).
EFFECTS OF THE SHORT-RANGE ORDER ON THE ENERGY OF INTER-ATOMIC REACTION AND HEAT OF DISPLACEMENT OF MOLTEN ALLOYS OF NICKEL AND SILICON
M. S. Petrushevskii, P. V. Geld, and L. E. Abramycheva [1973] 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), v. 10, 1972 p 17-20
(NLL-M-21597-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A method is given for calculating the short-range order parameters of alloys of nickel and silicon at 1600 C; the method is based on allowing for the concentrational change in the atom interaction energy. The interatomic reaction energy in the alloys investigated, with different amounts of the components, is assessed. The maximum strengthening of the bonds between the atoms of nickel and silicon approximately corresponds to the compound Ni_3Si_2. Examples of calculating the heat of mixing in Ni, Si-alloys at 1600 C are given. Author

N73-24569* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD AND APPARATUS FOR SPUTTERING UTILIZING AN APERTURED ELECTRODE AND A PULSED SUBSTRATE BIAS Patent
John S. Przybyszewski and Richard K. Shaltens, inventors (to NASA) Issued 8 May 1973 3 p Filed 14 Jan. 1971 Supersedes N71-31130 (09-18, p 2935)
(NASA-Case-LEW-10920-1; US-Patent-3,732,158; US-Patent-Appl-SN-106424; US-Patent-Class-204-192) Avail: US Patent Office CSCL 11F

The method and equipment used for sputtering by use of an apertured electrode and a pulsed substrate bias are discussed. The technique combines the advantages of ion plating with the versatility of a radio frequency sputtered source. Electroplating is accomplished by passing a pulsed high voltage direct current to the article being plated during radio frequency sputtering. P.N.F.

N73-24570# Defence Research Establishment Valcartier (Quebec).
APPLICATION OF POWDER TECHNOLOGY TO MILITARY HARDWARE
J. P. Drolet Dec. 1972 34 p refs
(DREV Proj. 97-01-19)
(DREV-TN-2035/72) Avail: NTIS HC $3.75

A short description of powder metallurgy and its possible application to the manufacture of military hardware is discussed. The first part deals with the experimental aspects of producing compacts from powders. The basic processes of material preparation and compaction as well as the advantages of powder technology over conventional casting methods are given. The second part considers the application of powder technology to the Defence Industry and includes a list of materials used in such diverse applications as; structural components, armour systems, ballistic components, electronic devices, and some others. Author

N73-24571# Technical Research Centre of Finland, Helsinki. Materials and Processing Technology.
INVESTIGATION OF THE STRUCTURE AND STABILITY OF

CAST IRON IN FINISHED MACHINE PARTS BY ULTRASONIC RADIATION [UNTERSUCHUNG DER STRUKTUR UND DER FESTIGKEIT VON GUSSEISEN IN FERTIGEN MASCHINENTEILEN MITTELS ULTRASCHALLS]
Jaakko Salokangas 1972 15 p refs In GERMAN; ENGLISH summary
Avail: NTIS HC $3.00

Ultrasonics were employed to study the effect of graphite on the strength characteristics of cast iron. The shape, size, and amount of the graphite were studied with the use of the velocity and damping properties of longitudinal ultrasound. The damping factor measurements were made by direct contact, using grease, and by the water immersion method. A method is presented for determining the tensile strength of gray cast iron on the basis of the number of repeated echoes, using a reference specimen.
Author

N73-24572*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FEASIBILITY OF PRODUCING CAST-REFRACTORY METAL-FIBER SUPERALLOY COMPOSITES
Ruluff D. McIntyre Washington May 1973 19 p refs
(NASA-TM-X-2782; E-7317) Avail: NTIS HC $3.00 CSCL 11F

A study was conducted to evaluate the feasibility of direct casting as a practical method for producing cast superalloy tungsten or columbium alloy fiber composites while retaining a high percentage of fiber strength. Fourteen nickel base, four cobalt, and three iron based matrices were surveyed for their degree of reaction with the metal fibers. Some stress-rupture results were obtained at temperatures of 760, 816, 871, and 1093 C for a few composite systems. The feasibility of producing acceptable composites of some cast nickel, cobalt, and iron matrix alloys with tungsten or columbium alloy fibers was demonstrated.
Author

N73-24573*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT OF THE WELD-BRAZE JOINING PROCESS
Thomas T. Bales, Dick M. Royster, and Winfrey E. Arnold, Jr. Washington Jun. 1973 42 p refs
(NASA-TN-D-7281; L-8784) Avail: NTIS HC $3.00 CSCL 13H

A joining process, designated weld-brazing, was developed which combines resistance spot welding and brazing. Resistance spot welding is used to position and aline the parts, as well as to establish a suitable faying-surface gap for brazing. Fabrication is then completed at elevated temperature by capillary flow of the braze alloy into the joint. The process was used successfully to fabricate Ti-6Al-4V alloy joints by using 3003 aluminum braze alloy and should be applicable to other metal-braze systems. Test results obtained on single-overlap and hat-stiffened panel specimens show that weld-brazed joints were superior in tensile shear, stress rupture, fatigue, and buckling compared with joints fabricated by conventional means. Another attractive feature of the process is that the brazed joint is hermetically sealed by the braze material, which may eliminate many of the sealing problems encountered with riveted or spot welded structures. The relative ease of fabrication associated with the weld-brazing process may make it cost effective over conventional joining techniques.
Author

N73-24574*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DETERMINATION OF HYDROGEN IN MILLIGRAM QUANTITIES OF TITANIUM AND ITS ALLOYS
Dumas A. Otterson and Robert J. Smith Washington Jun. 1973 19 p refs
(NASA-TN-D-7326; E-7297) Avail: NTIS HC $3.00 CSCL 11F

An accurate, versatile, and sensitive method for the determination of hydrogen in milligram-size titanium samples is presented. It involves extraction of hydrogen at 1070 K while a mercury diffusion pump transfers the evolved gases into the inlet of a mass spectrometer. All the evolved gases may then be positively identified and determined. This method can be readily adapted for use with other metals and for the study of the slow evolution of hydrogen. Reduction of interferences due to the evolution of hydrogen by reactions involving vapors such as those of water, acetone, and vacuum grease is discussed.
Author

N73-24575# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
LIQUID STATE SPECTRAL EMISSIVITIES OF TITANIUM, VANADIUM, ZIRCONIUM, MOLYBDENUM, AND PLATINUM IN AN ELECTRON-BEAM FURNANCE
R. K. Koch, J. L. Hoffman, and R. A. Beall [1973] 29 p refs
(BM-RI-7743) Avail: NTIS HC $3.50

The normal spectral emissivities of liquid Ti, V, Zr, Mo, and Pt were determined at the fusion temperatures in an electron beam furnace using a water-cooled copper hearth. The spectral emissivities for titanium and zirconium decreased with increasing temperature. The emissivities of vanadium and molybdenum were constant at 0.41 + or - 0.02 and 0.33 + or - 0.01, respectively. The spectral emissivity of platinum was constant at 0.39 + or - 0.02 up to 1, 900 C; above that temperature anomalous data were obtained. A mass spectrometric study indicated that platinum was reacting with backstreaming silicon vapors from the diffusion pump.
Author

N73-24576*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DISPERSION STRENGTHENED NICKEL-YTTRIA SHEET ALLOY PRODUCED FROM COMMINUTED POWDERS
Paul F. Sikora and Max Quatinetz 1973 18 p refs Proposed for presentation at 4th Intern. Powder Metallurgy Conf., Toronto, Canada, 15-20 Jul. 1973; sponsored by Am. Powder Metallurgy Inst. and the Metal Powder Ind. Federation
(NASA-TM-X-68245; E-7495) Avail: NTIS HC $3.00 CSCL 11F

An investigation was conducted to determine whether a nickel matrix with yttria as a dispersoid could be produced by a comminution and blending (wet attrition-NASCAB) approach. Concentration of yttria, powder cleaning temperature, screening (sieving) of the powders, and amount of thermomechanical working were major variables. Tensile strength and stress-rupture life at 1093 C were determined. A product containing 4v/o Y_2O_3, cleaned at 315 or 371 C with screening exhibited 1093 C tensile strength equivalent to NASCAB Ni-4ThO2 and to commercially produced thoriated nickel sheet.
Author

N73-24577# European Atomic Energy Community, Brussels (Belgium). Bureau Eurisotop.
TECHNOLOGICAL AND ECONOMIC IMPORTANCE OF THE DETERMINATION OF OXYGEN IN NON-FERROUS METALS
G. Kraft Apr. 1972 49 p refs In FRENCH
(EURISOTOP-59) Avail: AEC Depository Libraries

The effects of oxygen in nonferrous metals are outlined. The metals discussed are copper and its alloys, lead and its alloys, aluminum and its alloys, titanium, zirconium, vanadium, niobium, tantalum, molybdenum, tungsten, germanium, silicon, selenium, and the alkali metals. In Ti, O acts as a dissolved metal and affects the hardness, elasticity limit, and resistance to tension. The Zr behaves almost exactly as Ti, and O behaves as an alloying element which reenforces the qualities of resistance. The effects of O on the qualities of resistance decrease sharply as a function of temperature increase. Oxygen affects the ductile/fragile transition temperature in V and the hardness. Niobium and Ta possess a strong affinity for O, which exerts a strong influence on the mechanical properties. The presence of even flow amounts of O cause Mo and W to become so fragile that their fabrication is difficult. The economic importance of the determination of O in these metals is discussed.
NSA

N73-24578# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
EFFECT OF INERT GAS BUBBLES ON GRAIN GROWTH IN FOILS
S. C. Hobbs Nov. 1972 14 p refs
(RD/B/N-2430) Avail: AEC Depository Libraries

Examination of grain growth in vapor-deposited gold foils containing helium gas bubbles indicates that surface grooving is more important than the dispersed phase in impeding boundary motion in thin samples. The observed absence of bubble dragging is rationalized by considering the rate controlling process for bubble migration to be step nucleation on bubble facets, rather

than surface diffusion. From measurements of the limiting grain size, the ratio of grain boundary to surface energies is found to be 0.017 to 0.021. The low value is attributed to low angle boundaries between the epitaxial grains. NSA

N73-24579# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
EFFECT OF POINT DEFECTS ON MECHANICAL PROPERTIES OF METALS Technical Progress Report, 1 Jan. - 31 Dec. 1972
M. Meshii 1972 7 p refs
(Contract AT(11-1)-1367)
(COO-1367-50) Avail: NTIS

Developments are reported for studies on etch pit study of motion and generation of dislocations in electron-irradiated Cu, effects of electron irradiation on mechanical properties of Fe, and theory of dislocation motion and strength in bcc metals. The dislocation etch pit method was also established Al single crystals and ZrH2 purified Battelle-AISI Fe. A method for doping single crystal specimens with C in a controlled manner was also developed. NSA

N73-24580# Atomics International, Canoga Park, Calif.
SURVEY OF HELIUM EMBRITTLEMENT OF VARIOUS ALLOY TYPES
D. Kramer, K. R. Garr, A. G. Pard, and C. G. Rhodes 8 Dec. 1972 22 p refs
(Contract AT(04-3)-824)
(AI-AEC-13047) Avail: NTIS

The effects of helium on the uniform and total elongation, at 700 C, of alloys from different classes, were investigated using helium-injected miniature tensile samples. These alloys consisted of simple austenitic stainless steels, austenitic stainless steels with added titanium, nickel-base alloys, and ferritic stainless steels, plus others. The total elongation of every alloy except TZM was reduced by helium whereas uniform elongations suffered little or no reductions in many cases. The alloys with the best ductility in the presence of helium were Type 316H stainless steel (high carbon) and 12R72. Author (NSA)

N73-24581# Case Western Reserve Univ., Cleveland, Ohio. Div. of Metallurgy and Materials Science.
RADIATION DAMAGE STUDY OF TYPE 304 STAINLESS STEEL BY HIGH VOLTAGE ELECTRON MICROSCOPY
Gopal Das and T. E. Mitchell 1972 41 p refs
(Contract AT(11-1)-2119)
(COO-2119-3) Avail: NTIS

The AISI Type-304 stainless steel was used as a prototype to study electron irradiation damage as a function of accelerating voltage, irradiation time, and temperature. Discs 0.4 mm thick were cut from as-received 3 mm rods, sand-ground to approximately 0.2 mm, and most of them encapsulated in a quartz tube under a vacuum of 0.00001 torr and subsequently annealed at 1100 C for 7 hours. Electron-transparent foils were made from annealed and as-received discs by a two-step process of jet dimpling and electropolishing. These foils were exposed to electron radiation inside a Hitachi HU-650B microscope operating at an accelerating voltage of 650 kV (which is above the threshold energy for atom displacements in stainless steel) at temperatures between room temperature and 640 C. Typical results of radiation damage for different temperatures and exposure time are shown. NSA

N73-24582# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material und Festkoerperforschung.
AGE HARDENING BEHAVIOR OF V-Ti, V-Ti-Si, V-Zr, AND V-Hf ALLOYS WITH REFERENCE TO THE METALLOID N, O, B, AND C
H. Scholz Sep. 1972 40 p refs In GERMAN; ENGLISH summary
(KFK-1680) Avail: AEC Depository Libraries

An investigation was made to determine the influence of N, O, B, and C on the precipitation- and age-hardening-behavior of the alloys V-Ti, V-3Ti-Si, V-2Zr, and V-1Hf. Specifically the investigation was made to determine what effect these interstitials have on the age-hardening processes and whether this effect has to be taken into account for fuel element cladding. Possible new applications for age-hardened vanadium alloys outside of the nuclear field were evaluated. The alloys V-Ti-O and V-Hf-C showed an increase in hardness after temperature treatments. A high carbon content in the alloy V-Ti-O prevents age hardening. Age hardening was increased by additions of boron and silicon. The age-hardening processes can be used for a possible improvement of the creep strength to temperatures up to 750 C, since above this temperature averaging occurs after a short time. In order to avoid a too-high resistance to deformation during the extrusion of V-Ti-O alloys, the extrusion temperature has to be higher than 800 C. Author (NSA)

N73-24583# Bhabha Atomic Research Centre, Bombay (India). Metallurgy Div.
PREPARATION OF ZIRCONIUM-NIOBIUM ALLOY BY CARBIDE-OXIDE REACTIONS
R. Venkataramani, S. P. Garg, and C. V. Sundaram 1972 16 p refs
(BARC-612) Avail: AEC Depository Libraries

The direct preparation of Zr-Nb master alloys by reaction between ZrC and Nb2O5 is investigated. The thermodynamics of the reaction are discussed. Starting with two different compositions corresponding to 5% and 15% excess oxygen over the stoichiometric requirements, and adopting progressive heat soaking under high dynamic vacuum, followed by electron beam melting, zirconium-niobium alloys low in carbon and oxygen were prepared. The influences of initial oxygen excess and time of heat soak on the final purity of the alloy were examined. The overall material balance for the reaction indicates removal of oxygen both through carbothermic reduction (as CO) and through sacrificial deoxidation (as ZrO). Author (NSA)

N73-24584# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Abteilung Metallkunde.
PHASE TRANSFORMATIONS IN THE TITANIUM ALLOY TiAl6V4 [PHASENUMWANDLUNGEN IN DER TITANLEGIERUNG TiAl6V4]
Majda Majdic and Guenter Ziegler 19 Jan. 1973 61 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-38) Avail: NTIS HC $5.25; DFVLR Porz-Wahn: 20,50 DM

The effect of microstructure on the compensation of fluctuations in concentration, and on the formation of martensite were studied with two charges of the titanium alloy TiAl6V4 which differed in amounts, grain size and morphology of the beta-phase. The kinetics of the phase transformations are summarized in isothermal and continuous TTT-plots. The combination of the results of early studies with the present detailed analysis on the effect of the metastable beta-phase on transformation products and processes gives the present state of the transformation behavior in the titanium alloy TiAl6V4.
Author (ESRO)

N73-24585# Naval Postgraduate School, Monterey, Calif.
COMPUTER SIMULATION OF INERT GAS INTERSTITIALS IN TUNGSTEN M.S. Thesis
Richard David Williams, III Dec. 1972 101 p refs
(AD-758501) Avail: NTIS CSCL 20/2

Computer simulation techniques were used to determine equilibrium positions and binding energies of inert gas atoms implanted in a tungsten crystal and to investigate the potential wells around these equilibrium positions in both perfect lattices and relaxed lattices. Stable positions were found for inert gas interstitials near lattice atoms in the third and fourth layers of the crystal. Interstitial positions near atoms in the first and second layers of the crystal appeared to be unstable if they exist at all. As a result of potential well studies, it was concluded that the mechanism associated with equilibrium position formation was a combination of local liquefaction of the lattice structure and interaction of the interstitial with lattice atoms. (Author Modified Abstract) GRA

N73-24586# Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics and Materials Science.
ON THE GENERAL NATURE OF THE FINITE DEFORMATION OF ANNEALED METALS INCLUDING LOADING AND UNLOADING CONSTITUTIVE EQUATIONS AND SECOND ORDER TRANSITIONS Final Report, 1 Aug. 1970 - 30 Sep.

1972
James F. Bell Feb. 1973 16 p refs
(Contract F44620-70-C-0082; AF Proj. 9782)
(AD-758261; AFOSR-73-0516TR) Avail: NTIS CSCL 11/6

The research results are described for the final two years of a systematic experimental and theoretical study of the finite deformation of annealed metals. Reference is included to the development of an experimentally based set of modified incremental constitutive equations and path independent parabolic loading surfaces which are found to provide a detailed description of this class of solids. The measurements are from experiments on tension-torsion of tubes subject to a wide variety of radial and nonradial loading paths as well as experiments in double compression on cubical specimens. Reference is also made to new studies of second order transitions in these response functions which have been shown in this research to occur at a fixed set of eight critical shear angles. (Author Modified Abstract) GRA

N73-24587# Michigan Univ., Ann Arbor. Dept. of Engineering Mechanics.
USE OF ACOUSTIC EMISSION IN NONDESTRUCTIVE TESTING Final Technical Report, 1 Jul. 1968 - 31 Aug. 1971
Julian R. Frederick Wright-Patterson AFB, Ohio. AFML Oct. 1972 91 p refs
(Contract F33615-68-C-1703; ARPA Order 1244)
(AD-758216; AFML-TR-72-114) Avail: NTIS CSCL 11/6

A model based on the activation of dislocation sources was developed for predicting the effect of microstructure on acoustic emission. The model predicts a minimum dislocation source length and slip distance below which no emission will be detected. Experimental results obtained on various metals and alloys having different microstructures substantiate the model. The effect of grain size on the acoustic emission from 99.99% aluminum and 99.9% copper suggests that macroscopic yielding in these metals occurs with the help of dislocation pile-ups that have been held up by grain boundaries and that the emission results from the activation of dislocation sources near the grain boundaries. Experimental results obtained under conditions of very low background noise level show that some metals produce acoustic emission when the applied load is removed. The amount of emission that is observed correlates with the magnitude of the Bauschinger effect in the metal. In those metals that show an unload acoustic emission effect there is the possibility of using it to investigate the magnitude of the residual stress in a specimen. Creep and fatigue phenomena can also be studied by the use of acoustic emission. (Author Modified Abstract) GRA

N73-24588# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
RF SPUTTER ETCHING OF Al, SiO2 AND PHOTORESIST M.S. Thesis
Kenneth D. Wilkinson Dec. 1972 130 p refs
(AD-757878; GE/EE/73-23) Avail: NTIS CSCL 09/1

The procedures followed to determine the feasibility of using an RF-generated argon plasma to sputter etch windows through 8000 A of SiO2 are described in this thesis. The sputtered windows will be used to fabricate Schottky diodes and interconnections for multilayer devices. The RF sputter etch rate for Al, SiO2 and Waycoat photoresist was investigated at various self-bias voltages and longitudinal magnetic fields. All experiments were carried out at 27.12 MHz and 10 m torr argon pressure. (Author Modified Abstract) GRA

N73-24589# Army Materials and Mechanics Research Center, Watertown, Mass.
PROCESSING AND PROPERTIES OF 18Ni MARAGING STEEL BY POWDER METALLURGY
Ernest P. Abrahamson, II Feb. 1973 17 p refs
(DA Proj. 1B5-64603-D-663)
(AD-758439; AMMRC-TR-73-4) Avail: NTIS CSCL 11/6

Using 18Ni Mar 300 powder processed by the rotating electrode process, rods were extruded under varying temperatures and ram speeds. It is observed that control of both variables allows structure control and increases the Charpy V-notch toughness from 7 to 23 ft-lb at room temperature. Author (GRA)

N73-24590# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONTEMPORARY HEAT RESISTANT COPPER CONDUCTOR ALLOYS
M. V. Zakharov 3 Apr. 1973 17 p refs Transl. into ENGLISH from the publ. "Splavy Tsvetnykh Metallov" USSR, 1972 p 198-204
(AD-758618; FTD-HT-23-157-73) Avail: NTIS CSCL 11/6

The report discusses the development of copper alloys with the necessary heat resistance and electrical conductance for use as welding electrodes. GRA

N73-24591# Aerospace Corp., El Segundo, Calif.
STRESS CORROSION CRACKING AND HYDROGEN EMBRITTLEMENT OF HIGH-STRENGTH FASTENERS Final Report, Jun. 1971 - Jan. 1972
James K. Stanley 30 Apr. 1973 53 p refs
(Contract F04701-72-C-0073)
(AD-758754; TR-0073(3413-1)-1; SAMSO-TR-73-131) Avail: NTIS CSCL 11/6

Unexpected, brittle failures of high-strength fasteners on aerospace vehicles have been caused by stress corrosion cracking (SCC) and by hydrogen stress cracking (HSC). Despite extensive study, much remains to be learned about the phenomena. The poorly understood failure mechanisms are difficult to differentiate, especially in the field. There is a growing use of the term SCC to describe failure by both mechanisms. Data are given to characterize the classes. For low alloy carbon steels heat-treated to yield strengths below approximately 160 ksi, stress corrosion is not a problem, nor is hydrogen embrittlement (delayed cracking) very common. Above 160 ksi, difficulties can occur. The high-strength, precipitation-hardening, stainless steels have varying degrees of resistance to stress-corrosion cracking and hydrogen embrittlement, depending upon strength level and heat-treating procedures that influence the microstructure. (Author Modified Abstract) GRA

N73-24592# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
STUDIES ON THE WARM WORKING CHARACTERISTICS OF ALLOYS Final Report, 8 Sep. 1971 - 7 Dec. 1972
Conrad M. Young, Eldon M. Cady, and Oleg D. Sherby Dec. 1972 57 p refs
(Contract DAAG46-72-C-0021; DA Proj. 1T0-62105-A-328)
(AD-758912; AMMRC-TR-72-27) Avail: NTIS CSCL 11/6

The deformation of AISI type 304 austenitic stainless steel, Mangalloy (Fe-14% Mn-3%Ni), E-Brite 26-1 (Fe-26% Cr-1%Mo) ferritic stainless steel, 1018 steel containing 0.5%W, and 7075 aluminum has been studied in torsion over a range of deformation conditions representative of warm working (0.4-0.6Tm, where Tm is the melting temperature of the alloy at strain rates from 0.01/s to 6.3/s). The results obtained at the various temperatures and strain rates were analyzed taking into account atom diffusivity and elastic modulus plotting the data as diffusion compensated strain rate versus the modulus compensated stress for each alloy. A clear separation in strength characteristics between the various alloys was obtained when the contribution from dislocation pipe diffusion was included in the diffusion coefficient indicating that diffusion along dislocations is important during warm working. (Author Modified Abstract) GRA

N73-24593# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW MAGNESIUM ALLOYS FOR OPERATION AT ELEVATED TEMPERATURES
M. E. Drits, Z. A. Sviderskaya, and N. E. Nikitina 3 Apr. 1973 12 p refs Transl. into ENGLISH from Splavy Tsvetnykh Metallov (USSR), 1972 p 193-197
(FTD Proj. 60107)
(AD-758617; FTD-HT-23-156-73) Avail: NTIS CSCL 11/6

The report presents properties of magnesium-scandium-yttrium-manganese alloys. GRA

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N73-24594 Virginia Polytechnic Inst. and State Univ., Blacksburg
INVESTIGATION OF VACUUM EFFECTS ON THE MECHANICAL PROPERTIES OF COMPOSITE MATERIALS Ph.D. Thesis
Morris Lee Evans 1972 120 p
Avail: Univ. Microfilms Order No. 72-29574

Vacuum induced effects on the mechanical properties of several polymeric based materials were investigated. Two of the materials tested were space capsule heat ablators. The polymer base of both these materials was poly-(methyl, phenyl-siloxane). A third material investigated was a solid propellant whose polymeric binder was a butadiene-acrylic acid copolymer. This propellant was filled with a bimodal particle size distribution of ammonium perchlorate and was designated TPH 3105. The samples were stored in relative humidity environments of either 25 percent, 50 percent or 75 percent for a minimum of two weeks prior to vacuum exposure. These samples were then tested in continuous vacuum environments using an intermittent shear technique. A torsion pendulum apparatus was developed for these in situ tests. Storage and loss moduli and log decrements were determined in the tests. Dissert. Abstr.

N73-24595 Michigan Univ., Ann Arbor.
STRUCTURE AND DEFORMATION OF GLASSY AMORPHOUS POLYMERS Ph.D. Thesis
Thomas Edwin Brady 1972 280 p
Avail: Univ. Microfilms Order No. 72-29003

The plastic deformation mechanism of glassy amorphous polymers is investigated. The X-ray diffraction, electron microscopy, and density measurement were employed to characterize the structural changes which occur during deformation while both compression and tensile testing were used to characterize mechanical behavior. Electron microscope studies showed that plastic deformation is nonhomogeneous and proceeds, in both tension and compression, by localized shear at 100 to 1000 A interspacings. Annealing undeformed glassy polymers just below Tg was found to increase polymer density, apparent yield strength and the polymer's susceptibility to localized plastic deformation, also shear banding and crazing. Preliminary results indicate that thermal treatment does not affect the wide angle X-ray diffraction (WAXD) patterns of undeformed glassy polymers, while annealing of cold drawn glassy polymers just below Tg was found to completely eliminate the WAXD arcing while inducing approximately 25% recovery of the cold drawn deformation. Dissert. Abstr.

N73-24596 Utah Univ., Salt Lake City.
SURFACE ABLATION OF SILICA-REINFORCED COMPOSITES Ph.D. Thesis
Chia-Lung Hsieh 1972 225 p
Avail: Univ. Microfilms Order No. 72-29551

Based on a descriptive analysis of the ablation mechanism of reinforced composites, a set of governing equations were formulated to represent this process. With appropriate assumptions, these equations were then converted into a set of two-dimensional, two-phase, laminar, boundary-layer flow equations. The boundary conditions of these equations were also carefully analyzed and assigned. Two mathematical models were developed to modify the general governing equations. These are the model of mixture flow and the model of constant drift velocities. For the model of mixture flow, the method of similarity transforms was used. The transformed ordinary differential equations were then linearized by both small perturbation and quasilinearization methods. The resulting equations were solved by a special algorithmic procedure which yielded a more stable numerical calculation and produced a consistent converged solution. For the model of constant drift velocities, the integration method was utilized. By comparing relative magnitudes of various constants and variables, several quantities of the governing equations were deleted. The resulting equations were integrated analytically. Dissert. Abstr.

N73-24597*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROCESSABLE HIGH TEMPERATURE RESISTANT ADDITION TYPE POLYIMIDE LAMINATING RESINS
Tito T. Serafini and Peter Delvigs Washington May 1973 15 p refs
(NASA-TM-X-2798; E-7324) Avail: NTIS HC $3.00 CSCL 11D

Basic studies that were performed using model compounds to elucidate the polymerization mechanism of the so-called addition-type (A-type) polyimides are reviewed. The fabrication and properties of polyimide/graphite fiber composites using A-type polyimide prepolymers as the matrix are also reviewed. An alternate method for preparing processable A-type polyimides by means of in situ polymerization of monomer reactants (PMR) on the fiber reinforcement is described. The elevated temperature properties of A-type PMR/graphite fiber composites are also presented. Author

N73-24598*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
COMPUTER SIMULATION OF THRESHOLD SENSITIVITY DETERMINATIONS Final Report
J. B. Gayle [1973] 29 p refs
(NASA-TM-X-64087) Avail: NTIS HC $3.50 CSCL 11D

A computer simulation study was carried out to evaluate various methods for determining threshold stimulus levels for impact sensitivity tests. In addition, the influence of a number of variables (initial stimulus level, particular stimulus response curve, and increment size) on the apparent threshold values and on the corresponding population response levels, was determined. Finally, a critical review of previous assumptions regarding the stimulus response curve for impact testing is presented in the light of the simulation results. Author

N73-24599*# Aerojet Nuclear Systems Co., Azusa, Calif.
INDUCTION GRAPHITIZING FURNACE ACCEPTANCE TEST REPORT
Mar. 1972 101 p refs
(NASA-CR-132216) Avail: NTIS HC $7.25 CSCL 11D

The induction furnace was designed to provide the controlled temperature and environment required for the post-cure, carbonization and graphitization processes for the fabrication of a fibrous graphite NERVA nozzle extension. The acceptance testing required six tests and a total operating time of 298 hrs. Low temperature mode operations, 120 to 850 C, were completed in one test run. High temperature mode operations, 120 to 2750 C, were completed during five tests. Author

N73-24600# Army Missile Command, Redstone Arsenal, Ala. Physical Sciences Directorate.
STRENGTH RESULTS FOR TWO BRITTLE MATERIALS UNDER BIAXIAL STRESSES
Richard E. Ely 1 Sep. 1972 41 p refs
(DA Proj. 1T0-62106-A-330)
(AD-758448; RR-72-11) Avail: NTIS CSCL 11/2

Strength results for graphite and a filled epoxy material are reported for all four stress quadrants. A new test method was developed for this work. Different specimen gage lengths were employed and strength magnitudes were found to be quite dependent upon this geometrical parameter for biaxial compressive stresses. Comparisons of the current and past data also are made. Internal friction criteria are suggested as being suitable for predicting the strength behavior of the two test materials. Author (GRA)

N73-24601# Army Materials and Mechanics Research Center, Watertown, Mass.
INTERRELATIONS AND BOUNDS ON MODULI IN COMPOSITE MATERIALS
Edward M. Lenos Dec. 1972 25 p refs
(DA Proj. 1T0-61102-B-32A)
(AD-758438; AMMRC-TR-72-38) Avail: NTIS CSCL 11/4

The governing linear anisotropic elastic field equations for composite materials are reviewed. It is well known that

applications of tensor formalism to the general anisotropic constitutive relations lead to invariant relations and transformation laws for compliances and stiffnesses. These results combined with considerations of material volume change, the restrictions associated with positive definite strain energy density, and the requirements of physically meaningful response can be used to derive bounds and interrelationships between the anisotropic moduli for the various classes of material symmetry. These theoretical requirements are compared to available experimentally determined materials constants for filamentary composites and the applicability of the different anisotropic constitutive relations is discussed. Author (GRA)

N73-24602# General Electric Co., Schenectady, N.Y. Corporate Research and Development.
INVESTIGATION OF CERAMICS FOR HIGH TEMPERATURE TURBINE VANES Final Report, 1 Apr. - 13 Dec. 1973
Svante Prochazka 31 Dec. 1972 70 p refs
(Contract N00019-72-C-0129)
(AD-757796; SRD-72-171) Avail: NTIS CSCL 11/2

The objective of the work has been to investigate those parameters which limit the mechanical properties of SiC at high temperatures. The main approach used in this work has been to optimize processes and compositions for the base structural ceramic, SiC, such that appropriate microstructures could be obtained by hot-pressing at low pressures. These materials are then subjected to high-temperature mechanical tests. (Author Modified Abstract) GRA

N73-24603# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Mechanical Engineering.
THE DUCTILE BRITTLE TRANSITION OF LOW DENSITY POLYETHYLENE
Dan Weissmann Oct. 1972 96 p refs
(Contract F19628-72-C-0100; AF Proj. 7659; AF Proj. 6665)
(AD-757885; ME-RT-72007; AFCRL-72-0638; SR-1) Avail: NTIS CSCL 11/9

An extensive test program to determine the brittleness of low density, blown polyethylene film was undertaken as a result of failures of high altitude balloons constructed of this film. In this work, ductility and brittleness are defined by the ultimate elongations in uniaxial, constant strain rate tests. At each strain rate used it is shown that a critical temperature could be defined where the ultimate elongation changes significantly, (i.e., where the behavior changes from ductile to brittle). It is suggested that this temperature be considered the cold brittleness temperature. (Author Modified Abstract) GRA

N73-24604# Franklin Inst. Research Labs., Philadelphia, Pa.
RESEARCH ON DENSIFICATION, CHARACTER AND PROPERTIES OF DENSE SILICON NITRIDE Annual Report, Mar. 1972 - Mar. 1973
Peter E. D. Morgan Mar. 1973 26 p refs
(Contract N00014-72-C-0262)
(AD-757748; FIRL-A-C3316) Avail: NTIS CSCL 11/2

Methods are being devised for the simple preparation of silicon imides. Reactive hot pressing of these has already produced silicon nitride (alpha and beta forms) as dense as ever achieved before using pure material without additives. Author (GRA)

N73-24605# Monsanto Research Corp., St. Louis, Mo.
TAILORING THE INTERFACE IN GRAPHITE REINFORCED POLYCARBONATE
J. L. Kardos, F. S. Cheng, and T. L. Tolbert Feb. 1973 36 p refs
(Contract N00014-67-C-0218; ARPA Order 876)
(AD-757763; HPC-71-145) Avail: NTIS CSCL 11/4

Pronounced effects of thermal treatment on the properties of graphite fiber/polycarbonate and glass fiber/polycarbonate composites have been demonstrated and explained. At 20 volume percent loading of random-in-a-plane, discontinuous fiber, both specimen strength and modulus in both fiber systems were found to increase dramatically upon molding above 260-265C, whereas only the graphite system was further improved by subsequent annealing. Hot forming of graphite reinforced polycarbonate composites between the molding and annealing steps takes advantage of the higher processability of the unannealed material in addition to providing increased modulus and strength in the final molded article. (Author Modified Abstract) GRA

N73-24606# Michigan Univ., Ann Arbor. Dept. of Materials and Metallurgical Engineering.
GLASSY CARBONS Semiannual Progress Report, 1 Jun. - 31 Dec. 1972
Edward E. Hucke Jan. 1973 100 p refs
(Contract DAHC15-71-C-0283; ARPA Order 1824)
(AD-757765) Avail: NTIS CSCL 11/2

A large number of glassy carbon samples was produced by controlled pyrolysis of furfural alcohol resins, examined for structural differences, and evaluated for physical and mechanical properties. It is concluded that glassy carbon is a family of materials whose properties can be varied over a significant range, depending both on the small scale (2-50A) carbon structure, and the amount and distribution of porosity which may be present in substantial amounts. The combination of availability, chemical stability, low density and high strength make glassy carbons look promising for mechanical applications, particularly at very high temperatures. GRA

N73-24607# Plastics Technical Evaluation Center, Dover, N.J.
PLASTICS FABRICATION BY ULTRAVIOLET, INFRARED, INDUCTION, DIELECTRIC AND MICROWAVE RADIATION METHODS
Arthur F. Readdy, JR. Apr. 1972 162 p refs
(AD-756214; PLASTEC-R43) Avail: NTIS CSCL 11/9

The actual and possible uses of essentially non-ionizing radiation in the fabrication of plastics are surveyed. Ultraviolet, infrared, induction, dielectric and microwave heating are explored. Included are discussions of those methods which have reached industrial acceptance, and those techniques which have reasonably well-defined commercial potential. These topics are supplemented by limited discussion on the theory and the physics of the various radiations. The following fabrication methods are discussed. Crosslinking or curing; Heating and drying; Bonding; Thermoforming; and Preheating for transfer molding. The materials and end items to which one or more of these methods are applicable include: glass-reinforced polyesters (laminates, pipes, etc.); coatings and inks; formed sheets; thermoplastic bonded products; molded phenolics, epoxies and other thermosets; ablation shields; urethane foams for furniture, etc.; foundry core binders; and rubber-like materials. Guidelines regarding advantages, disadvantages, and general economics of using these essentially non-ionizing radiations are given. GRA

N73-24608# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRENGTH OF PLASTICS
Ya. Nemets, S. V. Serensen, and V. S. Strelyaev 15 Jan. 1973 377 p refs Transl. into ENGLISH of the publ. "Prochnost Plastmass" USSR, 1970 p 1-336
(AD-758626; FTD-HC-23-1044-72) Avail: NTIS CSCL 11/9

Results are presented of studies of the resistance of reinforced and unreinforced structural plastics to static and fatigue failure. Attention is devoted to the formation and development of brittle fracture of Plexiglas and polystyrene with account for the role of the residual stresses, the deformation and fracture of glass reinforced plastics under static and low-cycle loads, and also fatigue processes in connection with energy dissipation and the fracture condition temporal relationships. The use of the relations governing the resistance of plastics to deformation and fracture for evaluating the strength of structural elements is examined. Author (GRA)

N73-24609# Michigan Univ., Ann Arbor. Dept. of Materials and Metallurgical Engineering.
PRELIMINARY REPORTS, MEMORANDA AND TECHNICAL NOTES OF THE MATERIAL RESEARCH COUNCIL SUMMER CONFERENCE
Edward E. Hucke Jul. 1972 584 p refs Conf. held at Centerville, Mass.
(Contract DAHC15-71-C-0253; ARPA Order 2341)
(AD-758571) Avail: NTIS CSCL 14/2

Papers were presented in the following areas: Polymers, Mechanical properties, Crystallography, Composite materials,

Brittle materials, Elastic wave propagation, Gradient materials, etc. GRA

N73-24610# Hughes Aircraft Co., Culver City, Calif.
DEVELOPMENT OF COMPOSITE CONSTRUCTIONS WITH IMPROVED RAIN EROSION RESISTANCE Final Summary Report, 1 Dec. 1971 - 31 Dec. 1972
Boyce G. Kimmel Jan. 1973 126 p refs
(Contract N00019-72-C-0257)
(AD-758650; HAC-P73-43; HAC-Ref-C6212) Avail: NTIS CSCL 11/9

The report describes the continued investigation of composite constructions with improved rain erosion resistance. The studies include the effect on the rain erosion resistance as determined by whirling arm tests of such variables as matrix, reinforcement, reinforcement configuration, fiber loading, impact angle and fiber angle. Matrices evaluated included rigid epoxies, flexibilized epoxies, polyurethanes, polyphenylene oxide, polybutadiene and polyimide. Reinforcements included ECG glass, SCG glass, Nomex and Dacron. Most of the work involved the evaluation of reinforcements in unidirectionally reinforced, end-oriented composites. However, a limited effort was also expended in evaluating multi-dimensional fabrics. (Author Modified Abstract) GRA

N73-24611# Douglas Aircraft Co., Inc., Long Beach, Calif.
DEVELOPMENT OF A GRAPHITE HORIZONTAL STABILIZER Interim Technical Report, 1 Jul. - 31 Dec. 1972
George M. Lehman, D. M. Purdy, F. C. Allen, C. G. Dietz, and R. Teodosiadis Jan. 1973 125 p refs
(Contract N00156-70-C-1321)
(AD-758718; MDC-J5841) Avail: NTIS CSCL 11/4

The analysis, repair, and further static testing of the previously failed graphite horizontal stabilizer are described. The design, analysis, and development testing of redesign concepts to correct the understrength condition at the main pivot fitting joint are discussed. Finite element analyses of the joint region were conducted to quantify the interlaminar shears and bending moments induced in the laminated skin panel by secondary bending effects. The calculated interlaminar shear and tensile stresses were of the order of 5 to 10 percent of allowable stresses determined in quality control specimens. The failed static test article was repaired with bolted and bonded steel splice plates and additional static tests were conducted to verify the strengths of the three elevator hinge brackets and supporting structures. These tests successfully demonstrated the design integrity of the hinge brackets since loads in excess of design ultimate load (150 percent design limit load) were sustained in each case. Joint specimens were tested to evaluate two redesign concepts (i.e., bonded external scarf and internal stepped-lap titanium doublers) to correct the understrength condition at the pivot fitting joint. The latter concept was selected for further development because it eliminated design reliance on laminate properties in the immediate vicinity of the major bolted joint. (Author Modified Abstract) GRA

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N73-24612# National Aerospace Lab., Tokyo (Japan).
COORDINATE TRANSFORMATION ALGORITHM BY THE EULERIAN ANGLES REPRESENTATION
Yoshiaki Ohkami 1972 14 p refs In JAPANESE; ENGLISH summary
(NAL-TR-305) Avail: NTIS HC $3.00

It is described how to express the attitude of an aerospace vehicle by the Eulerian angles for computer simulation, and an algorithm is introduced. By this algorithm, the coordinate transformation matrix is calculable if any three values of the Eulerian angles and their rotation order are given. The relations between the time derivatives of Eulerian angles and the body angular velocity can be obtained. The method of avoiding Eulerian angle singularity is discussed. Three flow charts of the computer program based on this algorithm, are shown. Author

N73-24613*# Texas Univ., Austin. Applied Mechanics Research Lab.
GENERATION AND APPLICATION OF THE EQUATIONS OF CONDITION FOR HIGH ORDER RUNGE-KUTTA METHODS
Dennis Clyde Haley May 1972 91 p refs
(Contract NAS8-27931)
(NASA-CR-130902; AMRL-1042) Avail: NTIS HC $6.75 CSCL 12A

This thesis develops the equations of condition necessary for determining the coefficients for Runge-Kutta methods used in the solution of ordinary differential equations. The equations of condition are developed for Runge-Kutta methods of order four through order nine. Once developed, these equations are used in a comparison of the local truncation errors for several sets of Runge-Kutta coefficients for methods of order three up through methods of order eight. Author

N73-24614*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CLASSICAL EIGHTH- AND LOWER-ORDER RUNGE-KUTTA-NYSTROEM FORMULAS WITH A NEW STEPSIZE CONTROL PROCEDURE FOR SPECIAL SECOND-ORDER DIFFERENTIAL EQUATIONS
Erwin Fehlberg Washington Jun. 1973 54 p refs
(NASA-TR-R-410; M-544) Avail: NTIS HC $3.00 CSCL 12A

New Runge-Kutta-Nystrom formulas of the eighth, seventh, sixth, and fifth order are derived for the special second-order (vector) differential equation $x = f(t,x)$. In contrast to Runge-Kutta-Nystrom formulas of an earlier NASA report, these formulas provide a stepsize control procedure based on the leading term of the local truncation error in x. This new procedure is more accurate than the earlier Runge-Kutta-Nystrom procedure (with stepsize control based on the leading term of the local truncation error in x) when integrating close to singularities. Two central orbits are presented as examples. For these orbits, the accuracy and speed of the formulas of this report are compared with those of Runge-Kutta-Nystrom and Runge-Kutta formulas of earlier NASA reports. Author

N73-24615# National Bureau of Standards, Washington, D.C. Applied Mathematics Div.
A PERFORMANCE COMPARISON OF LABELING ALGORITHMS FOR CALCULATING SHORTEST PATH TREES
Judith Gilsinn and Christoph Witzgall (Boeing Sci. Res. Labs.) May 1973 92 p refs
(NBS-TN-772) Avail: SOD HC $1.25 Domestic Postpaid or $1.00 GPO Bookstore as C13.46:772

Many applications in transportation and communication require the calculation of shortest routes between points in a network, and several algorithms for the solution of this problem exist in the literature. Algorithms which calculate a shortest route from one point in the network to all other intersection points are studied. Computer data handling techniques which can be used to improve the two basic algorithms in this class are investigated. Results of computer timing runs on various types and sizes of networks are compared, and the differences, sometimes of an order of magnitude, are analyzed. Detailed flowcharts and computer programs of the tested algorithms are also included. Author

N73-24616*# Scripta Technica, Inc., Washington, D.C.
THE COLLOCATION METHOD FOR DIFFERENTIAL EQUATIONS
A. I. Ivanov and V. I Ivanov NASA Jun. 1973 29 p refs Transl. into ENGLISH of "O Metode Kollokatsii dlya Differentsialnykh Uravnenii ", Acad. of Sci., USSR, Inst. for Space Res., Moscow, report Pr-120, 1972 35 p
(Contract NASw-2484)
(NASA-TT-F-14800; Pr-120) Avail: NTIS HC $3.50 CSCL 12A

A modification of the collocation method is proposed for use in the approximate solution of the Cauchy problem for a system of ordinary differential equations, the Goursat problem for systems of hyperbolic equations and the first boundary value

problem for a nonstationary system of Navier-Stokes equations. The existence and convergence of the approximate solutions obtained with this algorithm are examined. Estimates of the rate of convergence and a priori estimates of the errors are presented, together with numerical examples. Author

N73-24617*# Massachusetts Inst. of Tech., Cambridge.
THE INFINUM PRINCIPLE
Hans P. Geering (Oerlikon-Buehrle AG) and Michael Athans 21 Mar. 1973 46 p refs
(Grants NGL-22-009-124; AF-AFOSR-1941-70; AF-AFOSR-1724-69)
(NASA-CR-132052; ESL-P-492) Avail: NTIS HC $4.50 CSCL 12A

A complete theory of necessary and sufficient conditions is discussed for a control to be superior with respect to a nonscalar-valued performance criterion. The latter maps into a finite dimensional, integrally closed directed, partially ordered linear space. The applicability of the theory to the analysis of dynamic vector estimation problems and to a class of uncertain optimal control problems is demonstrated. Author

N73-24618# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
ENTIRE EINSTEIN SPACE OF MAXIMAL MOBILITY AND PETROV TYPE II
M. E. Osinovskii 1972 12 p refs In RUSSIAN; ENGLISH summary
(ITF-72-140-P) Avail: AEC Depository Libraries

The space V of Petrov type 2 (x does not equal zero) of maximal mobility and acting in the motion group G is investigated. G is homeomorphic to the Euclidean space R5. V is a homogeneous space of left cosets of G and is homeomorphic to the Euclidean space R4. Author (NSA)

N73-24619# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NUMERICAL SMOOTHING AND INTERPOLATION METHODS [SUR QUELQUES METHODES NUMERIQUES DE LISSAGE ET D'INTERPOLATION]
Claude LeComte and Gerard Faye Nov. 1972 22 p refs In FRENCH; ENGLISH summary
(ONERA-NT-205) Avail: NTIS HC $3.25

Various interpolation and smoothing methods are reviewed. They include: smoothing of a set of equidistant points, adaptation of the same method to the case of nonequidistant points, smoothing based on radii of curvature, interpolation through spline functions, smoothing through spline function, and another smoothing method through spline functions. Author (ESRO)

N73-24620# Army Research Office, Durham, N.C.
PROCEEDINGS OF THE 1972 ARMY NUMERICAL ANALYSIS CONFERENCE
Oct. 1972 96 p refs Conf. held at Edgewood Arsenal, Md., 20-21 Apr. 1972; sponsored by Army Math. Steering Comm.
(AD-758145; AROD-72-3) Avail: NTIS CSCL 12/1

Contents: Initial value methods for nonlinear boundary value problems and integral equations; Optoelectronic computational techniques for fast picture processing; An algorithm for rapidly parsing automatically digitized drawings; Evaluation of the roots of cross-product Bessel functions; Application of pattern recognition to shock-trauma studies; Aerodynamic parameter identification in ballistic range tests; The WSMR best estimate of trajectory - An overview; A computer program to investigate exo-atmospheric engagements of interceptors and re-entry vehicles; The wind tunnel free flight testing technique; Some aspects of regularization and approximation of solutions of III-posed operator equations; Kinetics analysis by digital parameter estimation. GRA

N73-24621# Michigan Univ., Ann Arbor. Computer Information and Control Engineering.
STATIONARY POINT PROCESSES AND APPLICATIONS TO COMMUNICATIONS AND LOGISTIC SYSTEMS Annual Status Report, 1 Jun. 1971 - 31 May 1972
Frederick J. Beutler Jan. 1973 8 p refs
(Grant AF-AFOSR-1920-70; AF Proj. 9769)
(AD-758281; AFOSR-73-0520TR) Avail: NTIS CSCL 12/1

The research has proceeded along three distinct lines. (1) The behavior of closed loop control systems with randomly timed sampling within the feedback loop. Random sampling in a feedback context occurs in systems with a controller consisting of a time shared computer, control systems with imperfect samplers, and remote control whose feedback function is performed at a distance via a pulse coded transmission link. (2) Recovery of data from samples taken at random intervals, including time-multiplexed communication systems and real-time digital handling of data. (3) The applicability of martingale theory to stochastic point processes. In particular, the Doob decomposition for continuous-parameter supermartingales which is crucial to the modern theory of detection and estimation of stochastic signals corrupted by additive white noise. (Author Modified Abstract) GRA

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N73-24622 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 100, NO. 5: CLIMATOLOGY OF THE STRATOSPHERE IN THE NORTHERN HEMISPHERE. PART 2: GEOSTROPHIC WINDS AT 100, 50, 30, AND 10 mb
Harry VanLoon, Roy Jenne, L., and Karin Labitzke 1972 165 p refs
Avail: Issuing Activity

A climatological treatment of the stratospheric wind above the 100 mb level is considered, along with the 50 mb level and the 50 to 30 mb levels, using observed winds. Geostrophic winds computed from monthly mean pressure height gradients based on the daily analyses of the area north of LON, and supplemented between sea level and 200 mb with geostrophic winds computed from the heights are also reported. Author

N73-24623 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 133, NO. 3: THE EUROPEAN CLIMATOLOGY 1972. WEATHER SATELLITE OBSERVATIONS AT THE BERLIN APT STATION, PART 3 [METEOROLOGISCHE ABHANDLUNGEN. BAND 133, HEFT 3: DAS EUROPAEISCHE WETTERBILD 1972 WETTERSATELLITEN-DATEN AUS DEM BERLINER EMPFANGSBEREICH, TEIL 3, 3. VIERTELJAHR]
Ingrid Haupt 1972 240 p In GERMAN
(Qr-3-Pt-3) Avail: Issuing Activity

ESSA 8 photographic observations of the European cloud cover for the third quarter in 1972 are presented. All cloud mosaics contain a geographic coordinate net constructed from sub-satellite points. Included brief scientific reports deal with ERTS 1 technology and the identification of smoke from forest fires in satellite cloud pictures. Transl. by G.G.

N73-24624 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 129, NO. 2: DAILY GROUND MAPS OF THE NORTHERN HEMISPHERE FOR 1972, PART 2 [METEOROLOGISCHE ABHANDLUNGEN. BAND 129, HEFT 2: TAEGLICHE BODENKARTEN DER NORDHEMISPHAERE IM JAHRE 1972, TEIL 2, 2. HALBJAHR]
Horst Boettger 1972 377 p In GERMAN
(Qr-2-Pt-2) Avail: Issuing Activity

The present volume continues the series of ground weather maps. It contains daily height and temperature analyses of constant pressure levels for July through December 1972 of the whole of the Northern Hemisphere. Transl. by G.G.

N73-24625 National Lending Library for Science and Technology, Boston Spa (England).
RESULTS OF EXPERIMENTAL WEATHER FORECASTING USING SATELLITE INFORMATION
S. I. Ponomarenko 20 Oct. 1972 13 p refs Transl. into

ENGLISH from Tr. Gidrometeorol. Nauchn.-Issled. Tsentr. SSSR (Leningrad), v. 90, 1971 p 59-69
(NLL-M-22897-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Weather forecasting (12-hours) without the use of visual data on clouds or other meteorological parameters was studied to determine the practical value of satellite information for forecasts. An assessment of 350 experimental 12-hour forecasts showed that the experimental forecasts averaged 9% lower than routine forecasts. The difference in accuracy was greater for December and June, i.e., 17 and 25% respectively lower than routine forecasts. The causes for these differences are discussed. It is concluded that infrared and TV photographs of clouds can be successfully used for short range forecasts. F.O.S.

N73-24626 National Lending Library for Science and Technology, Boston Spa (England).
THE FORECASTING OF HAIL, THUNDERSTORMS AND SHOWER PRECIPITATION
G. K. Sulakvelidze, N. I. Glushkova, and L. M. Predchenko 9 Jun. 1972 210 p refs Transl. into ENGLISH of book published by Vysokogornyj Geofiz. Inst., 1970 188 p No diagrams etc. to be used in conjunction with original book
(NLL-M-22902-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 21 NLL photocopy, coupons

Methods of forecasting hail, thunderstorms, and amounts of shower precipitation are described. The thermodynamical conditions of the origin of convection which lead to the formation and fall of showery precipitation and hail were examined. A method is described for the calculation of the maximum velocity of an ascending current in a cloud. The influence of wind shear on the development of convection and on the formation of precipitation is discussed. A method of forecasting hail, based on the physical conditions of its formation in a cloud is described, also methods of forecasting the amounts of precipitation and the calculation of the amount of precipitation for different heat contents before the development of convection and after the fall of precipitation. The amount of water due to a cloud is calculated. A description is given of a method for forecasting hail, also techniques for preparing these forecasts and examples of their preparation are given. Author

N73-24627 National Lending Library for Science and Technology, Boston Spa (England).
THE PRESENT STATE OF POLLUTION OF RAIN WATER
L. Shramek [1973] 6 p refs Transl. into ENGLISH from Hydromet., Ustav, Meeorol. Zpravy (Prague), v. 24, 1971 p 70-71 No diagrams etc., to be used in conjunction with orginal book
(NLL-M-22857-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The establishment of a network of stations for analyzing the pollution of rain water in Czechoslovakia is discussed. The method for conducting the analysis is outlined. A comparison of the pollution levels existing at different locations is reported. Author

N73-24628 National Lending Library for Science and Technology, Boston Spa (England).
SOME GENERAL PRINCIPLES OF THE CONSTRUCTION OF WEATHER FORECASTING SCHEMES USING ANALOGUES
Ju. E. Katin 10 Mar. 1972 7 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchn.-Issled. Isentr. SSSR (Leningrad), 1971 p 69-74
(NLL-M-22852-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The preparation of long range weather forecasts using the principle of the analogy of the fields of the meteorological elements is discussed. The use of the analog method is investigated. The system is based on two dimensional, normally distributed, random vectors, the components of which have zero mathematical expectation. Mathematical models are developed to clarify the theoretical concepts. Author

N73-24629 Nevada Univ., Reno.
AN ANALYSIS OF IMPROVED NUMERICAL SOLUTIONS TO THE STOCHASTIC COLLECTION EQUATION FOR CLOUD DROPLETS Ph.D. Thesis
Richard Lee Reinhardt 1972 119 p
Avail: Univ. Microfilms Order No. 72-29755

Solutions to the stochastic collection equation for cloud droplet growth were obtained for a range of initial distributions of cloud droplets and a systematic relationship to the initial spectra was shown. The numerical solutions matched the analytic solutions over the entire range of the spectrum within 1% while the liquid water content, initially 1.0 gm cu m, increased by 0.36% for the sum-of-the-masses kernel and 0.04% for the constant kernel after 30 minutes of real time. The liquid water content error was shown to be indicative of the accuracy of the solution at the spectrum's tail and was thereafter used to appraise the accuracy of solutions for the realistic kernels. For these collection kernels the error in liquid water content was less than 1.0%. Dissert. Abstr.

N73-24630 Florida State Univ., Tallahassee.
ATMOSPHERIC CHEMISTRY OF COASTAL AEROSOLS, CLOUD DROPLETS AND RAIN Ph.D. Thesis
Christopher Sargent Martens 1972 172 p
Avail: Univ. Microfilms Order No. 72-27925

The chemical changes occurring during the transformation of aerosols to cloud droplets and rain were observed in orographic clouds on the eastern end of the island of Puerto Rico. Comparisons of elemental ratios in particles and rain and of elemental particle size distributions in and out of the clouds demonstrated scavenging efficiencies greater than 100 percent for the elements I, Br and Cl relative to Na and less than 25 percent for the elements Al, Mn and V relative to Na. These different scavenging efficiencies are consistent with predictions based on existing cloud physics theory and are a reflection of the geochemical properties of the aerosol consisting partially of a hygroscopic sea salt component containing I, Br, Cl and Na and partially of a soil dust component containing Al, Mn and possibly V. Dissert. Abstr.

N73-24631 Florida State Univ., Tallahassee.
SIMULATION OF AN ASYMMETRIC HURRICANE WITH A FINE MESH MULTIPLE GRID PRIMITIVE EQUATION MODEL Ph.D. Thesis
Mukut Behari Mathur 1972 178 p
Avail: Univ. Microfilms Order No. 72-27927

A 4 level primitive equation model was designed to study the development of an asymmetric hurricane. In order to predict over a large area with a fine resolution near the center of the hurricane, a multiple grid system was constructured to minimize the number of grid points. A stable workable procedure for grid nesting is demonstrated. The total release of latent heat in the convective clouds is set proportional to the boundary layer convergence of water vapour and its vertical distribution is determined in a manner similar to Kuo. The nonconvective release of latent heat in the stably-stratified upper troposphere is also parameterized. The transfer of sensible and latent heat from sea to air and the variation of Coriolis parameter with latitude are included. Features typical of hurricanes that are realistically simulated include: organized bands in the vertical motion field surrounding the eye, downward motion in the eye, and cyclonic outflow in the upper troposphere. Dissert. Abstr.

N73-24632 Oklahoma Univ., Oklahoma City.
ANALYSIS OF STORMFURY DATA USING THE VARIATIONAL OPTIMIZATION APPROACH Ph.D. Thesis
Robert C. Sheets 1972 158 p
Avail: Univ. Microfilms Order No. 72-29912

The variational optimization technique is used to develop an analysis scheme for application to the high energy portion of a hurricane (wind speeds of 30 kn or more contained in the storm circulation). The derived analysis equations are used to filter the data in an attempt to obtain the signal for selected scales of motion. The design of the filters used in this study was based on empirical evidence. These filters are also used to develop variability factors for the standard meteorological variables and selected scales of motion. A second set of analysis equations is derived which includes the first set as well as the gradient wind condition. The analysis schemes are applied to data collected in Hurricane Debbie (1969) during two artificial modification attempts. The results of these analyses are then used to define

a more explicit seeding hypothesis which can be used in the explanation and statistical evaluation of future seeding experiments. Dissert. Abstr.

N73-24633 Syracuse Univ., N.Y.
THE ENERGETIC ROLE OF THE TRADE WIND INVERSION IN A TROPICAL SUBALPINE ECOSYSTEM Ph.D. Thesis
Robert Evans Dohrenwend 1972 324 p
Avail: Univ. Microfilms Order No. 72-29332

It was postulated that at high altitudes in the tropics, the energy environments of vegetation formations are strongly modified by the behavior of the trade wind inversion. A study of this phenomenon and its ability to control energy fluxes at a tropical subalpine surface was made at 3500 meters in the Talamanca Mountains of Costa Rica from August 16, 1970 to September 4, 1971. An attempt was made to characterize as many different aspects as possible of the ecosystem of this area. The controlling roles of the trade wind inversion are evaluated. The general behavior of the ecosystem is presented in an energy flow network analog, using the notation developed by H. T. Odum (1969). The trade wind inversion is visualized in this network as operating a number of workgates controlling the atmospheric elements of the ecosystem's energy input/output schedule. Dissert. Abstr.

N73-24634*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TEMPORAL VARIATIONS IN THE DAWN AND DUSK MIDLATITUDE TROUGH POSITION-MODELED AND MEASURED (ARIEL 3)
J. M. Grebowsky, Y. Kabasakal Tulunay (Birmingham Univ.), and A. J. Chen May 1973 26 p refs Submitted for publication
(NASA-TM-X-66253; X-621-72-149) Avail: NTIS HC $3.50 CSCL 04B

The temporal development of the latitudinal position of the 600 km midlatitude electron density trough at dawn and dusk during the period 25-27 May 1967, which encompassed a large magnetic storm, was measured by the RF capacitive probe on the polar orbiting Ariel 3 satellite. The substorm-related changes in the L coordinate of the trough minimum and the point of most rapid change of density gradient on the low latitude side of the trough are similar. Oscillations of the trough position at dusk are in phase with substorm activity whereas movement of the trough at dawn is only apparent with the onset of the large storm. Near dusk there is evidence of structure in the form of a tail-like extension of the plasmasphere at the peak of the storm. Detailed model calculations assuming a spatially invariant equatorial convection E field which varies in step with K sub p index reproduces much of the observed behavior, particularly at dusk, and shows that more than one plasmapause-type transition may be identifiable in the trough region. Author

N73-24635# California Univ., Livermore. Lawrence Livermore Lab.
ASSESSMENT OF AIR POLLUTION MODELING AND METEOROLOGY
M. H. Dickerson 27 Nov. 1972 26 p refs Presented at the Calif. Univ. Proj. Clean Air Conf., Riverside, Calif., 14-15 Dec. 1972 Sponsored by AEC
(UCRL-74335; Conf-721208-1) Avail: NTIS

Some of the problems encountered in air pollution modeling meteorology are discussed, and some of the efforts to find answers to these problems, especially within the State of California, are reviewed. The development of a mass-consistent wind field model for the San Francisco Bay Area is discussed in some detail. Results from this model show that the observations of wind and the height of the inversion base above the terrain can be adjusted so that much of the artificial mass loss/gain is removed while the major features of the respective fields are retained. Author (NSA)

N73-24636# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Feb. 1973 [OBSERVATIONS CLIMATOLOGIQUES BULLETIN MENSUEL, FEVRIER 1973]
Feb. 1973 16 p In DUTCH and FRENCH
Avail: NTIS HC $3.00

Meteorological parameters observed at different Belgian weather stations during February 1973 are given. ESRO

N73-24637# National Climatic Center, Asheville, N.C.
ENVIRONMENTAL GUIDE FOR THE US GULF COAST
W. A. Brower, J. M. Meserve, and R. G. Quayle Nov. 1972 180 p refs
(AD-758455; NOAA-73020906) Avail: NTIS CSCL 04/2

The report presents detailed environmental profiles for seven potential Gulf Coast Deep Water Port sites: Corpus Christi, Galveston-Freeport, Sabine Pass, Bayou Lafourche, Southwest Pass, Mobile-Pascagoula and Panama City. Each individual area guide provides information: general description of the area, an area map, pressure, extratropical cyclones, tropical cyclones, winds, extreme winds, waves, visibility, temperature (air and sea), precipitation, cloudiness, relative humidity, and land station summaries as well as marine area summaries. Author (GRA)

N73-24638# General Dynamics/Electronics, San Diego, Calif.
PROCESSED WIND AND WAVE MEASUREMENTS FROM OCEAN WEATHER STATION PAPA Technical Report, Oct. 1972 - Mar. 1973
C. K. Rutledge Mar. 1973 37 p
(Contract N00014-70-C-0180; NR Proj. 083-147)
(AD-757982; R73-010) Avail: NTIS CSCL 04/2

As part of an investigation into the environmental conditions existing in the North Pacific Ocean, observational data collected from ships occupying Ocean Weather Station PAPA were obtained from the Canadian Atmospheric Environment Service. Wind and wave data for the fall and winter months over the period 1951 through 1971 were processed. Wind speed and wave height were examined using a computer program to construct histograms displaying data distribution a monthly basis. Data were divided into two intervals (1951 through 1961, and 1962 through 1971) to compare the two periods since there is a general belief that wind/wave severity has diminished during the past 20 years. The histograms included in the report show that maximum wind speed data and the mean wave height data as reported indicate a definite lessening in environmental severity at the location. Mean wind speed data show a similar trend, but of a much smaller extent. Author (GRA)

N73-24639# Calspan Corp., Buffalo, N.Y.
EXPERIMENTAL TEST OF FOG CLEARING BY GROUND-BASED HEATING: VISIBILITY, TEMPERATURE, AND FOG MICROPHYSICS
C. William Rogers, Eugene J. Mack, and Roland J. Pilie Dec. 1972 74 p refs
(Contract F19628-72-C-0160; AF Proj. 8620)
(AD-757897; CJ-5076-M-1; AFCRL-TR-73-0056; SR-1) Avail: NTIS CSCL 04/2

Experimental tests of fog clearing by a ground-based heating system were carried out in nighttime advection fog occurring at Vandenberg Air Force Base, California during July and August 1972. Horizontal visibility ranged from 400 to 1000 m at one meter above the ground, 100 to 200 m between the 1 and 30 m heights and 50 to 100 m between the 30 and 60 m heights; average liquid water contents were 0.08, 0.22 and 0.38 g/cubic meter at 1, 13, and 42 m heights, respectively. Extrapolating the results of these experiments to a similar system installed at an airport, it appears that the visibility improvement achieved would always be adequate to permit landings at category 2 and category 3a runways. The clearing would usually be inadequate for approaches to category 1 runways unless the quantity of heat used was significantly increased. (Author Modified Abstract) GRA

N73-24640# Stanford Research Inst., Menlo Park, Calif.
FURTHER DEVELOPMENT OF OBJECTIVE METHODS FOR REGISTERING LANDMARKS AND DETERMINING CLOUD MOTIONS FROM SATELLITE DATA
Daniel E. Wolf, Roy M. Endlich, and David J. Hall Sep. 1972 76 p refs
(Contract N62306-71-C-0068)
(AD-757814) Avail: NTIS CSCL 04/2

The report describes continuing research to develop automatic methods for measuring cloud motions from digital brightness data obtained by geosynchronous satellites. A series of computer programs are described that register successive pictures using landmarks, normalize brightness for changing illumination, locate brightness centers (tracers) for groups of cloud elements, match

brightness centers in pairs to obtain a smooth field of motions, and transform the motions from tape coordinates to earth coordinates. The methods are economical computationally since coordinate transformations are made only to the cloud motion vectors obtained, and not to the millions of brightness elements of an image. Also, a data compression is accomplished by representing groups of bright points by their centers plus descriptors of the group shape. (Author Modified Abstract)
GRA

N73-24641# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
SOME CONSIDERATIONS ON THE FEASIBILITY OF ADVERTENT CLIMATE MODIFICATION
Henry Hidalgo Oct. 1972 137 p refs
(Contract DAHC15-73-C-0200)
(AD-757795; P-856; IDA/HQ-72-14325) Avail: NTIS CSCL 04/2

A general circulation model for climate, emphasizing physical phenomenology, is developed as part of an overall consideration; whether it is feasible to control or advertently modify the earth's surface climate at the middle and high northern latitudes. Ultimately, the answer to this feasibility question will be used to evaluate theoretically the current capabilities of world superpowers in their possible use of controlled climate modification for political or military purposes. The use of the model, along with the most recent reduction of experimental data for the long-term statistics of the current general circulation, allows the semi-experimental determination of certain statistics which are difficult to measure directly. These are the wave and amplitude parameters of the baroclinic disturbances, and the vertical transports, which the model determines as a function of latitude. A local test of the model proved successful: for the latitude where the large-scale transport of angular momentum vanishes as the large-scale transport of sensible heat reaches a maximum, experimental and semi-experimental results show agreement. (Author Modified Abstract) GRA

N73-24642# McGill Radar Weather Observatory, Ste. Anne de Bellevue (Quebec).
SHOWERS OBSERVED BY STEREO CAMERAS AND RADAR
Roderick W. Shaw and J. Stewart Marshall Oct. 1972 26 p refs
(Contract F19628-73-C-0052; AF Proj. 6672)
(AD-757882; AFCRL-72-0600; SR-53) Avail: NTIS CSCL 04/2

Panoramic (rotating-lens) cameras with fields 140 x 55 degrees have been used for stereoscopic photography of clouds, in conjunction with 10-cm radar observations. The photographs are linear in the parameters used in photogrammetry: azimuth and the tangent of the angle of elevation. (Author Modified Abstract) GRA

N73-24643# Alaska Univ., College. Geophysical Inst.
OBSERVATIONS OF THE DEVELOPMENT OF STRIATIONS IN LARGE BARIUM ION CLOUDS Final Technical Report
T. N. Davis, E. M. Wescott, and G. J. Romick Griffiss AFB, N. Y. RADC Jun. 1972 32 p refs
(Contract F30602-70-C-0179; ARPA Order 1057; Proj. SECEDE)
(AD-757916; RADC-TR-72-217) Avail: NTIS CSCL 04/1

Striations develop within large (12-352 kg releases) barium ion clouds in a two-stage process. First the clouds split into sheets commencing at the trailing edge of the cloud. Then distortions or pinching effects within the individual sheets cause the formation of field-aligned raylike structures. In the clouds observed, the individual sheets were 200 m to 1000 m in thickness and were spaced 700 m to 2000 m apart. Quasi-sinusoidal waviness or spatially periodic thickenings exhibited a wavelength typically 700 m to 1000 m. When rod-like structures appeared, these were typically 200 m to 400 m in diameter and were spaced along the pre-existing sheet at 700 m to 1000 m on centers. Author (GRA)

N73-24644# Meteorology International, Inc., Monterey, Calif.
THE DEVELOPMENT OF TECHNIQUES FOR OPERATIONAL EXPLOITATION OF SATELLITE INFRARED CHANNEL RADIANCES IN THE RESOLUTION OF ATMOSPHERIC THERMAL STRUCTURE VARIABILITIES. TASK ONE: PERSPECTIVE
Manfred M. Holl Sep. 1972 67 p refs
(Contract N62306-72-0125)
(AD-758734; M-181-1) Avail: NTIS CSCL 04/2

The report describes the development of techniques for operational exploitation of satellite infrared channel radiances in the resolution of atmospheric thermal-structure variables. The first step is to develop a perspective: position and orientation. The goal is information useful in a comprehensive weather analysis and forecasting system. Of primary interest are satellite measurements in radiance channels selected in strongly absorbing bands of a gas of uniform air mixing ratio (e.g., the 15-micron band of carbon dioxide). GRA

N73-24645# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
ATHENA H-008, FLIGHT 138, 29 MARCH 1973 Meteorological Data Report
George M. Fugate 29 Mar. 1973 51 p
(DA Proj. 1T6-65702-D-127)
(AD-758866; DR-769) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of Athena Flight 138, Vehicle H-008, are presented for the Air Force Space and Missile Systems Organization and for ballistic studies. The data are presented in tabular and figure form. Author (GRA)

N73-24646# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
ATHENA H-006, FLIGHT 139, 29 MARCH 1973 Meteorological Data Report
George M. Fugate 29 Mar. 1973 53 p
(DA Proj. 1T6-65702-D-127)
(AD-758867; DR-770) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of Athena Flight 139, Vehicle H-006, are presented for the Air Force Space and Missile Systems Organization and for ballistic studies. The data are presented in tabular and figure form. Author (GRA)

N73-24647# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 14101 RIP, MISSILE NOS. 9623/9034, ROUND NOS. 5/6, (1 FEBRUARY 1973)
Feb. 1973 27 p
(DA Proj. 1T6-65702-D-127)
(AD-758861; DR-763) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 14101 RIP, Missile Numbers 9623 and 9034, Round Numbers 5 and 6, are presented in tabular form. Author (GRA)

N73-24648# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 11602 LANCE, MISSILE NO. 2355, ROUND NO. 184 EST, (29 JANUARY 1973) Meteorological Data Report
Jan. 1973 46 p
(DA Proj. 1T6-65702-D-127)
(AD-758860; DR-761) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 11602 Lance, Missile Number 2355, Round Number 184 EST, are presented in tabular form. Author (GRA)

N73-24649# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 13901 LITTLE JOHN MISSILE NO. 2192, ROUND NO. 693 RM, (24 JANUARY 1973) Meteorological Data Report
24 Jan. 1973 19 p
(DA Proj. 1T6-65702-D-127)
(AD-758859; DR-760) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 13901 Little John, Missile Number 2192, Round Number 693 RM, are presented in tabular form. Author (GRA)

N73-24650# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 03702 HONEST JOHN MISSILE NO. 1003, ROUND NUMBER 631 AML, (20 MARCH 1973)
Mar. 1973 20 p

(DA Proj. 1T6-65702-D-127)
(AD-758869; DR-799) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 03702 Honest John, Missile Number 1003, Round Number 631 AML are presented in tabular form. Author (GRA)

N73-24651# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 14101 RIP MISSILE NOS. 12712/12716, ROUND NOS. 7/8, (9 FEBRUARY 1973)
Feb. 1973 22 p
(DA Proj. 1T6-65702-D-127)
(AD-758863; DR-764) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 14101 RIP, Missile Numbers 12712 and 12716, Round Numbers 7 and 8, are presented in tabular form. Author (GRA)

N73-24026 Ministry of Aviation, London (England).
THE RELATIONSHIP BETWEEN THE DISCRETE GUST AND POWER SPECTRA PRESENTATIONS OF ATMOSPHERIC TURBULENCE, WITH A SUGGESTED MODEL OF LOW-ALTITUDE TURBULENCE
J. K. Zbrozek *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1295-1318 refs Previously issued as RAE-TN-Aero-2682; ARC-21874 (For availability see N73-24011 15-01)
(ARC-R/M-3216; RAE-TN-Aero-2682; ARC-21874)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N73-24652# National Aerospace Lab., Tokyo (Japan).
ESTIMATION OF GUIDANCE ERRORS BY KALMAN-BUCY FILTERING TECHNIQUE
Masaaki Murata 1972 26 p refs In JAPANESE; ENGLISH summary
(NAL-TR-302) Avail: NTIS HC $3.50

The application is described of Kalman-Bucy filter theory to postflight guidance error analysis. Trajectory reconstruction and the estimation of guidance hardware errors and radar system errors are emphasized, such as accelerometer bias, gyro drift rate, radar location uncertainty and the like, by processing both guidance telemetered and radar tracking data. The filtering technique is developed in full detail for a launch vehicle with a strapdown inertial navigation system. Digital simulations are also presented. The results demonstrate that the approach is very promising for postflight guidance-trajectory analysis. Author

N73-24653*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A LOW-COST INERTIAL SMOOTHING SYSTEM FOR LANDING APPROACH GUIDANCE
Frank R. Niessen Washington Jun. 1973 32 p refs
(NASA-TN-D-7271; L-8763) Avail: NTIS HC $3.00 CSCL 17G

Accurate position and velocity information with low noise content for instrument approaches and landings is required for both control and display applications. In a current VTOL automatic instrument approach and landing research program, radar-derived landing guidance position reference signals, which are noisy, have been mixed with acceleration information derived from low-cost onboard sensors to provide high-quality position and velocity information. An in-flight comparison of signal quality and accuracy has shown good agreement between the low-cost inertial smoothing system and an aided inertial navigation system. Furthermore, the low-cost inertial smoothing system has been proven to be satisfactory in control and display system applications for both automatic and pilot-in-the-loop instrument approaches and landings. Author

N73-24654# Federal Aviation Administration, Washington, D.C.
SUMMARY OF NEAR TERM ENGINEERING AND DEVELOPMENT PROGRAM PLANS FOR GROUND BASED SEPARATION ASSURANCE
Mar. 1973 25 p refs
(FAA-EM-73-7) Avail: NTIS HC $3.25

A description is given of several engineering and development (E and D) activities directly involved with the development of automation capabilities to aid the separation assurance function of the ground based air traffic control (ATC) system. Separation assurance capabilities for the operational NAS En Route Stage A System are being developed in E and D Program 12 - En Route Control. The analogous development work for terminal systems, ARTS 3 and ARTS 2, is being accomplished in Program 14 - Terminal/Tower Control. The initial design of future capabilities, such as Intermittent Positive control for Phase 2 of the Upgraded Third Generation ATC System (which depends upon the surveillance/ communications provided by the Discrete Address Beacon System), is being performed under E and D Program 01 - Systems. In addition to work on ground based separation assurance, a parallel E and D program is being conducted to determine the potential value of an independent airborne collision avoidance system as a safety backup in the event of ground system failures. Author

N73-24655# Transportation Systems Center, Cambridge, Mass. Airport Surface Traffic Control Program Office.
ENGINEERING AND DEVELOPMENT PROGRAM PLAN: AIRPORT SURFACE TRAFFIC CONTROL
Jul. 1972 162 p refs
(FAA-ED-08-1) Avail: NTIS HC $10.25

Background, requirements, system descriptions, task descriptions, activities, schedules, and funding levels are presented for the Airport Surface Traffic Control program for the years 1972 to 1979. Systems, subsystems, proposed concepts, and equipments are defined and specified in a system context and then designed, developed, tested, and evaluated for introduction, in modular fashion, into the existing airport environment. Modular structure of the system will permit system configurations to be tailored to the needs of the individual airport and will permit modular expansion of either capacity or function to meet the airport's needs as they evolve with time. Author

N73-24656# ITT Avionics, Nutley, N.J.
SYSTEM ANALYSIS OF TACAN AND DME FOR ADDITION OF DIGITAL DATA BROADCAST Final Technical Report
John B. Kennedy and Ira Ross Apr. 1973 88 p refs
(Contract DOT-FA72WA-3001)
(FAA-RD-73-2) Avail: NTIS HC $6.50

An engineering analysis is presented on the feasibility of modifying the existing Tacan/DME system to provide broadcast digital data for area navigation. The operational and system considerations indicate that the required data rate is realizable and can be added with minimal effect on existing services. Various types of signal structure, synchronization and modulation techniques are examined. A comparison of the resulting data systems on the basis of data performance, flexibility, and the cost-complexity of implementation is included. Author

N73-24657# Stanford Research Inst., Menlo Park, Calif.
THE AIR TRAFFIC CONTROLLER'S CONTRIBUTION TO ATC SYSTEM CAPACITY IN MANUAL AND AUTOMATED ENVIRONMENTS. VOLUME 3: TERMINAL OPERATIONS Interim Report, Jun. 1971 - Jan. 1973
R. S. Ratner and J. O. Williams Jan. 1973 63 p
(Contract DOT-FA70WA-2142; SRI Proj. 8181)
(FAA-RD-72-63-Vol-3; IR-2) Avail: NTIS HC $5.25

The adaptation of the Relative Capacity Estimation Process (RECEP) to terminal ATC operations, findings and implications for effective automation in the terminal areas, quantitative capacity estimates, and predictions for several levels of automation are reported. A comparison of the results obtained for terminal ATC operations with those obtained for the ATC operations is presented. Author

N73-24658# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Technical Translation Branch.
COMPUTATION OF THE GEODETIC COORDINATES OF AN AIRCRAFT FROM TWO MEASURED DISTANCES AND ITS HEIGHT ABOVE THE SURFACE OF THE EARTH ELLIPSOID
K. A. Laping and L. V. Medvedev Dec. 1972 11 p Transl.

into ENGLISH from Gedez. i Kartograf. (Moscow), no. 3, 1972 p 13-15
(AD-757541; DMAAC-TC-1888) Avail: NTIS CSCL 08/5

The paper discusses the computation of the geodetic coordinates of an aircraft from two measured distances and its height above the surface of the earth ellipsoid. The advantages of the suggested method of determination of an aircraft's coordinates are: it is not necessary to reduce the measured distances to the surface of the earth ellipsoid, it is not necessary to know the approximate geodetic cpordinates of the aircraft, and the suggested formulas can be used advantageously in a computer. Author (GRA)

N73-24659# Boston Coll., Chestnut Hill, Mass. Space Data Analysis Lab.
PROCEDURES FOR THE DETERMINATION OF THE ATTITUDE OF A ROCKET FROM GYROSCOPIC DATA Final Report, 1 Sep. 1969 - 31 Aug. 1972
Judy A. Roxborough, Brian F. Sullivan, Rene J. Marcou, Marvin E. Stick, and Kathleen M. Geezil 30 Sep. 1972 90 p refs
(Contract F19628-70-C-0017)
(AD-758764; AFCRL-72-0740) Avail: NTIS CSCL 19/7

The system of procedures used to calculate the attitude of a rocket from gyroscopic roll, pitch and yaw is described. The nature of the outputs from two gyroscopic attitude systems are presented together with their associated conversions. A synopsis of the mathematics used to compute attitude is outlined. Various means of substantiating gyroscopic attitude by sensor outputs are discussed; these include the use of magnetometer, sun sensor and photometer data. Recovery procedures used when the gyro system malfunctions are also illustrated. Finally, recommendations to expedite attitude calculation are made. Author (GRA)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N73-24660*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPATIBILITY TESTS OF MATERIALS FOR A LITHIUM-COOLED SPACE POWER REACTOR CONCEPT
John H. Sinclair Washington May 1973 28 p refs
(NASA-TN-D-7259; E-7188) Avail: NTIS HC $3.00 CSCL 18J

Materials for a lithium-cooled space power reactor concept must be chemically compatible for up to 50,000 hr at high temperature. Capsule tests at 1040 C (1900 F) were made of material combinations of prime interest: T-111 in direct contact with uranium mononitride (UN), Un in vacuum separated from T-111 by tungsten wire, UN with various oxygen impurity levels enclosed in tungsten wire lithium-filled T-111 capsules, and TZM and lithium together in T-111 capsules. All combinations were compatible for over 2800 hr except for T-111 in direct contact with UN. Author

N73-24661*# Atomics International, Canoga Park, Calif.
SYSTEM STATISTICAL RELIABILITY MODEL AND ANALYSIS SNAP Program
V. S. Lekach and H. Rood 8 Jun. 1973 55 p refs
(NASA Order C-21030-C; Contract AT(04-3)-701)
(NASA-CR-121205; AI-AEC-13098; C-92b) Avail: NTIS HC $4.75 CSCL 14D

A digital computer code was developed to simulate the time-dependent behavior of the 5-kwe reactor thermoelectric system. The code was used to determine lifetime sensitivity coefficients for a number of system design parameters, such as thermoelectric module efficiency and degradation rate, radiator absorptivity and emissivity, fuel element barrier defect constant, beginning-of-life reactivity, etc. A probability distribution (mean and standard deviation) was estimated for each of these design parameters. Then, error analysis was used to obtain a probability distribution for the system lifetime (mean = 7.7 years, standard deviation = 1.1 years). From this, the probability that the system will achieve the design goal of 5 years lifetime is 0.993. This value represents an estimate of the degradation reliability of the system. Author

N73-24662*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CAVITY TEMPERATURE AND FLOW CHARACTERISTICS IN A GAS-CORE TEST REACTOR
Henry A. Putre Washington Jun. 1973 27 p refs
(NASA-TM-X-2797; E-7331) Avail: NTIS HC $3.00 CSCL 18I

A test reactor concept for conducting basic studies on a fissioning uranium plasma and for testing various gas-core reactor concepts is analyzed. The test reactor consists of a conventional fuel-element region surrounding a 61-cm-(2-ft-) diameter cavity region which contains the plasma experiment. The fuel elements provide the neutron flux for the cavity region. The design operating conditions include 60-MW reactor power, 2.7-MW cavity power, 200-atm cavity pressure, and an average uranium plasma temperature of 15,000 K. The analytical results are given for cavity radiant heat transfer, hydrogen transpiration cooling, and uranium wire or powder injection. Author

N73-24663*# Atomics International, Canoga Park, Calif.
SPACE NUCLEAR SYSTEM EXPANSION JOINTS
W. D. Whitaker and T. T. Shimazki 4 Jun. 1973 29 p refs
(NASA Order C-21030-C; Contract AT(04-5)-701)
(NASA-CR-121209; AI-AEC-13092; M-3679-R69; C-92b) Avail: NTIS HC $3.50 CSCL 18I

The engineering, design, and fabrication status of the expansion joint unit (EJU) to be employed in the NaK primary coolant piping loop of the 5-kwe Reactor thermoelectric system are described. Four EJU's are needed in the NaK primary coolant piping loop. The four EJU's which will be identical, utilize bellows as the flexing member, are hermetically sealed, and provide double containment. The bellows are of a nested-formed design, and are to be constructed of 1-ply thickness of 0.010-in. Inconel 718. The EJU's provide a minimum piping load margin of safety of +0.22. Author

N73-24664*# Aerojet-General Corp., Sacramento, Calif.
NERVA 400E THRUST TRAIN DYNAMIC ANALYSIS Engineering Operations Report
D. F. Vronay 14 Apr. 1972 192 p refs Sponsored by NASA (Proj. 110)
(NASA-CR-132224; N8120R:72-027) Avail: NTIS HC $11.75 CSCL 21F

The natural frequencies and dynamic responses of the NERVA 400E engine thrust train were determined for nuclear space operations (NSO), and earth-orbital shuttle (EOS) during launch and boost conditions. For NSO, a mini-tank configuration was analyzed with the forward end of the upper truss assumed fixed at the stage/mini-tank interface. For EOS, both a mini-tank and an engine only configuration were analyzed for a specific engine assembly support (EAS) stiffness. For all cases the effect of the shield on dynamic response characteristics was determined by performing parallel analyses with and without the shield. Gimbaling loads were not generated as that effort was scheduled after the termination date. The analysis, while demonstrating the adequacy of the engine design, revealed serious deficiencies in the EAS. Responses at the unsupported ends of the engine are excessive. Responses at the nuclear subsystem interface appear acceptable. It is recommended that additional analysis and design effort be expended upon the EAS to ensure that all engine responses stay within reasonable bounds. Author

N73-24665*# Aerojet Nuclear Systems Co., Azusa, Calif.
INTERFACE CONTROL AND MRL PHASEDOWN REPORT
J. L. Smith May 1972 16 p
(NASA-CR-132215; Rept-110-F-6) Avail: NTIS HC $3.00 CSCL 21F

Engine interface control activities were performed to coordinate engine and component design activities in conformance with the 1137400E flight engine baseline. Interface control drawings were maintained. The preliminary operational flight engine measurement requirements list is consistent with design requirements, the flight engine configuration, and an allocated minimum measurement channel quantity. Author

N73-24666*# Aerojet-General Corp., Sacramento, Calif.
NERVA MASS PROPERTIES COMPUTER METHODOLOGY Engineering Operations Report
I. K. Hall 30 May 1972 253 p Sponsored by NASA (Proj. 187)
(NASA-CR-132221; N8120R:72-028) Avail: NTIS HC $14.75 CSCL 21F

The computer codes are presented that were used for the weight, center of gravity, and mass moment of inertia calculations and documentation for the NERVA. The two programs, E15301 and 12001B, are the basic tools used for weights work on the NERVA program. Used in conjunction with one another, they allow for rapid weights estimates for new concepts or changes while allowing for orderly documentation, which is a necessity in any effective weights effort. Program E15301 requires that each component be resolved into a collection of standard shapes. Separate subroutines then process geometric and material density data for each entry. The master program the performs all calculations necessary to combine these results into a total weight, center of gravity, and moment of inertia for the component. Program 12001B accepts previously calculated weight and center of gravity data for individual components. The program sums weights and calculates center of gravities and moments of inertia for systems of up to four levels of assemblies. The output identifies the engine parts in a format usable directly in a formal report. Author

N73-24667*# Aerojet Nuclear Systems Co., Azusa, Calif.
SUMMARY OF ENGINE DESIGN AND ANALYTICAL STUDIES TO MATURE THE 1137400E ENGINE BASELINE
D. E. Kleinert and W. A. Lester May 1972 30 p refs
(NASA-CR-132230; Rept-110-72J-1) Avail: NTIS HC $3.50 CSCL 21F

Activities in packaging components into integral module arrangements compatible with engine design requirements for the 1137400E flight engine baseline are summarized along with the applied mechanics and thermal analysis. Revisions to drawings, configurations, and support structures are discussed. F.O.S.

N73-24668*# Westinghouse Astronuclear Lab., Pittsburgh, Pa.
COMMON RADIATION ANALYSIS MODEL FOR 75,000 POUND THRUST NERVA ENGINE (1137400E)
E. A. Warman and B. A. Lindsey Apr. 1972 174 p Sponsored by NASA
(NASA-CR-132228; N8140R:72-0014) Avail: NTIS HC $10.75 CSCL 21F

The mathematical model and sources of radiation used for the radiation analysis and shielding activities in support of the design of the 1137400E version of the 75,000 lbs thrust NERVA engine are presented. The nuclear subsystem (NSS) and non-nuclear components are discussed. The geometrical model for the NSS is two dimensional as required for the DOT discrete ordinates computer code or for an azimuthally symetrical three dimensional Point Kernel or Monte Carlo code. The geometrical model for the non-nuclear components is three dimensional in the FASTER geometry format. This geometry routine is inherent in the ANSC versions of the QAD and GGG Point Kernal programs and the COHORT Monte Carlo program. Data are included pertaining to a pressure vessel surface radiation source data tape which has been used as the basis for starting ANSC analyses with the DASH code to bridge into the COHORT Monte Carlo code using the WANL supplied DOT angular flux leakage data. In addition to the model descriptions and sources of radiation, the methods of analyses are briefly described. Author

N73-24669*# Aerojet Nuclear Systems Co., Azusa, Calif.
NERVA NOZZLE DESIGN STATUS REPORT Engineering Operations Report
J. J. Williams, J. L. Pickering, and R. G. Ackerman May 1972 436 p refs Sponsored by NASA (Proj. 141)
(NASA-CR-132223; N8500:72-141-f-198-1) Avail: NTIS HC $24.00 CSCL 21F

The results of the design analyses are presented along with the status of the attained design maturity of the structural elements of the nozzle jacket and various aspects of the coolant passages. The design analyses relating to the nozzle shell were based on design allowables as supported by cursory values obtained from ARMCO 22-13-5 nozzle forgings. The major aspects of the coolant passages considered include: low cycle thermal fatigue, ability to operate at 4500 R gas temperature, tube buckling, and susceptibility to erosion. The scope of the analysis is limited to processes leading to reliability assessments of failure mechanisms. Author

N73-24670*# Aerojet Nuclear Systems Co., Azusa, Calif.
FLUID DYNAMICS COMPUTER PROGRAMS FOR NERVA TURBOPUMP
J. J. Brunner May 1972 461 p refs Sponsored by NASA (Proj. 121)
(NASA-CR-132222; N8300R:72-106) Avail: NTIS HC $25.25 CSCL 21F

During the design of the NERVA turbopump, numerous computer programs were developed for the analyses of fluid dynamic problems within the machine. Program descriptions, example cases, users instructions, and listings for the majority of these programs are presented. Author

N73-24671*# Aerojet Nuclear Systems Co., Azusa, Calif.
NERVA DYNAMIC ANALYSIS METHODOLOGY, SPRVIB
D. F. Vronay 26 May 1972 75 p ref Sponsored by NASA (Proj. 187)
(NASA-CR-132214; N8120R:72-030) Avail: NTIS HC $5.75 CSCL 21F

The general dynamic computer code called SPRVIB (Spring Vib) developed in support of the NERVA (nuclear engine for rocket vehicle application) program is described. Using normal mode techniques, the program computes kinematical responses of a structure caused by various combinations of harmonic and elliptic forcing functions or base excitations. Provision is made for a graphical type of force or base excitation input to the structure. A description of the required input format and a listing of the program are presented, along with several examples illustrating the use of the program. SPRVIB is written in FORTRAN 4 computer language for use on the CDC 6600 or the IBM 360/75 computers. Author

N73-24672*# Aerojet-General Corp., Sacramento, Calif.
VIBRATION COMPUTER PROGRAMS E13101, E13102, E13104, AND E13112 AND APPLICATION TO THE NERVA PROGRAM. PROJECT 187: METHODOLOGY DOCUMENTATION Engineering Operations Report
George Mironenko May 1972 262 p
(NASA-CR-132220; N8120R:72-038) Avail: NTIS HC $15.25 CSCL 21F

Programs for the analyses of the free or forced, undamped vibrations of one or two elastically-coupled lumped parameter teams are presented. Bearing nonlinearities, casing and rotor distributed mass and elasticity, rotor imbalance, forcing functions, gyroscopic moments, rotary inertia, and shear and flexural deformations are all included in the system dynamics analysis. All bearings have nonlinear load displacement characteristics, the solution is achieved by iteration. Rotor imbalances allowed by such considerations as pilot tolerances and runouts as well as bearing clearances (allowing conical or cylindrical whirl) determine the forcing function magnitudes. The computer programs first obtain a solution wherein the bearings are treated as linear springs of given spring rates. Then, based upon the computed bearing reactions, new spring rates are predicted and another solution of the modified system is made. The iteration is continued until the changes to bearing spring rates and bearing reactions become negligibly small. Author

N73-24673*# Aerojet-General Corp., Sacramento, Calif.
PHOTOELASTIC STRESS ANALYSIS METHODOLOGY AND APPLICATIONS TO NERVA STRUCTURES
R. C. Sampson 2 Jun. 1972 35 p refs Sponsored by NASA (Proj. 187)
(NASA-CR-132213; N8120R:72-034) Avail: NTIS HC $3.75 CSCL 21F

Experimental results are reported on the analysis of NERVA structures by photoelasticity. Structures analyzed include butterfly valve lip seal, impeller rotor, and roller bearings. E.H.W.

N73-24674*# Aerojet Nuclear Systems Co., Azusa, Calif.
DESIGN FABRICATION AND NONDESTRUCTIVE TESTING

OF SIX EXPERIMENTAL AGCARB/INTERMOLD 3 CYLINDER ASSEMBLIES
E. F. Thacher Apr. 1972 350 p Sponsored by NASA
(NASA-CR-132233; N8500:72-143-f-398-3) Avail: NTIS HC $19.50 CSCL 21F

Six subscale Intermold cylinder assemblies with a total of twelve different concepts for transition to AGCarb were fabricated. Three of the cylinder assemblies were made by helically winding the hoop fibers and three were of orthogonal configuration. The fabrication process is summarized and details of each manufacturing method are given. The objectives of the test program were to: (1) demonstrate the fabricability of the Intermold 3 subscale flanges, (2) produce an integral transition from Intermold 3 to AGCarb material, (3) define a workable manufacturing process, and (4) identify a best suited inspection method. The objectives were met and the results are described. Author

N73-24675# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
SPACE VEHICLE PROPELLED BY A NUCLEOTHERMAL ENGINE [VEHICULE SPATIAL A PROPULSION NUCLEOTHERMIQUE]
25 Jun. 1972 144 p Partly in FRENCH; partly in ENGLISH
(Contract ELDO-CTR-17/4/48)
(TR-TT-4-15/72) Avail: NTIS HC $9.25

In the context of a feasibility study of an upper stage for Europa 3 propelled by a thermal nuclear rocket engine, the following subsystems were studied: structure, electrical equipment, attitude control, and radiation shielding. For individual titles, see N73-24676 through N73-24680.

N73-24676 Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
PRELIMINARY DEFINITION OF THE STRUCTURE DEFINITION PRELIMINAIRE DE LA STRUCTURE] c31
Kohl *In its* Space Vehicle Propelled by a Nucleothermal Engine 25 Jun. 1972 18 p In FRENCH (For availability see N73-24675 15-22)
(Contract ELDO-CTR-17/4/48)
(TR-TK-Ref-1-374/72)

In the context of a feasibility study of a nuclear-thermal upper stage for the Europa 3 launch vehicle, the structures of stage and interstage are defined. The nuclear stage is placed above the second stage and entirely shrouded by the fairings. The interstage between the second stage and the nuclear stage supports its load. The separation system is also studied. The working fluid of the uranium pellet bed reactor is hydrogen, stored in the liquid state. This entails thermal insulation of the tank. ESRO

N73-24677 Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
PRELIMINARY STUDY OF THE ELECTRICAL EQUIPMENT c31
Weber *In its* Space Vehicle Propelled by a Nucleothermal Engine 25 Jun. 1972 15 p (For availability see N73-24675 15-22)
(Contract ELDO-CTR-17/4/48)
(TR-TT-4-16/72)

The requirements for the electrical equipment of the nuclear upper stage for Europa 3 derived from the mission and from interfaces with the other systems of the vehicle and with the other stages are studied for guidance and control, telemetry and telecommand and power supply systems. The baseline solution is considered in sufficient depth to permit a realistic estimate of equipment size, mass and power data, so as to assist in the demonstration of the feasibility of the nucleo-thermal propelled vehicle. The initial concept of having a central intelligence system serving all sub-systems was retained. This leads not only to a very clear interface and a good versatility for a wide spectrum of missions, including partial motor firings, but also to lower mass and lower required power. ESRO

N73-24678 Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
PRELIMINARY DEFINITION OF THE ATTITUDE CONTROL SYSTEM
Weber *In its* Space Vehicle Propelled by a Nucleothermal Engine 25 Jun. 1972 29 p (For availability see N73-24675 15-22)
(Contract ELDO-CTR-17/4/48)
(TR-TT-4-17/72)

The attitude control system design is mainly based on the mission profile where many phases of three-axis stabilization are needed and is also influenced by the fact that the velocity increment vector must have the proper orientation in space with a certain accuracy. A hydrozine system with an on-off mode for attitude control and pre-acceleration is proposed. The optimal control system, the fuel mass and thrust level are computed. The attitude control system is described. ESRO

N73-24679 Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
PRELIMINARY STUDY OF NUCLEAR RADIATION SHIELDING c31
Borchardt *In its* Space Vehicle Propelled by a Nucleothermal Engine 25 Jun. 1972 64 p (For availability see N73-24675 15-22)
(Contract ELDO-CTR-17/4/48)
(TR-TT-4-18/72)

The problems of nuclear radiation in a nuclear thermal propelled space vehicle are described. Basic considerations on radiation source, shielding against nuclear radiation and on the different effects of radiation are discussed. A calculation method for approximate calculations of radiation attenuation is described. The special problem of a liquid hydrogen tank as shielding device is discussed and a special formula for the time dependence of shielding slab thickness of liquid hydrogen is developed. The shielding problems of a nuclear-thermal propelled upper stage for Europa 3 are described and results of different investigations are reported. The problem of heat disposal by nuclear radiation in the liquid hydrogen tank and in the shielding devices is treated as well as a thermal balance of the shielding devices, optimization of shielding mass, and design of shielding. ESRO

N73-24680 Stuttgart Univ. (West Germany). Inst. fuer Kernenergetik.
SHIELDING CALCULATION OF A NUCLEAR PROPELLED SPACE VEHICLE (10 MW) Final Report c31
In ERNO Raumfahrttech. Space Vehicle Propelled by a Nucleothermal Engine 14 Dec. 1971 12 p (For availability see N73-24675 15-22)
(TN-3-25)

The radiation field of neutrons and gamma rays was determined for a given two-dimensional configuration of the stage consisting of a shadow shield with 1.7 cm U-238 (90 kg) and 10 cm LiH (80 kg) and a conical liquid hydrogen tank. The payload dose was calculated at a reference plane 20 cm above the liquid hydrogen tank, the latter as a function of the propulsion time as well as the integral over the whole propulsion period. First results show that the payload dose is on the safe side, however the exponentially increasing dose rate indicates that the payload dose depends strongly on the hydrogen content and its condition in the tank during the last minutes of propulsion. ESRO

N73-24681# Cryorocket, Neuilly (France).
STUDY OF A THERMAL NUCLEAR PROPULSION SYSTEM Progress Report, 1 Jun. 1971 - 31 Jan. 1972 [ETUDE D'UN SYSTEME DE PROPULSION NUCLEO-THERMIQUE 2EME PHASE DES TRAVAUX, 1 JUIN 1971 - 31 JANVIER 1972]
28 Feb. 1972 125 p refs In FRENCH Supersedes Rept-D-10/71
(Contract ELDO-CTR-17/3/129)
(D-1/72; PR-2; D-10/71) Avail: NTIS HC $8.25

A nuclear rocket engine for an upper stage of the Europa 3 launch vehicle is designed. The rocket engine consists of an uranium compound pellet bed through which an axial flow of hydrogen is heated to a high temperature. Hydrogen is let in by a turbine pump. The reactor power is 10 MW. The specific impulse developed is about 819 sec. The mass of the propulsion system (excluding the reactor and the shielding) is 77 kg. Increasing the power to 30 MW would result in a increase of 50 kg mass. ESRO

N73-24682# Battelle-Northwest, Richland, Wash. Reactor Physics Dept.
CONTROLLED THERMONUCLEAR REACTOR TECHNOL-

OGY Annual Report, 1972
W. C. Wolkenhauer, ed. Nov. 1972 152 p refs
(Contract AT(45-1)-1830)
(BNWL-1685) Avail: NTIS

An attempt was made to find solutions to some of the engineering problems of controlled thermonuclear reactor power plants. Problems cover neutronics, hybrid (fission and fusion) systems, fusion cross section theory, economics; and graphite materials, hydrogen isotope effects, thermal hydraulic analysis, sputtering effects, and irradiation induced swelling.
Author (NSA)

N73-24969 European Organization for Nuclear Research, Geneva (Switzerland).
ORGANISATION AND MANAGEMENT OF THE CERN/ISR PROJECT
C. J. Zilverschoon *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 71-76 (For availability see N73-24962 15-34)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N73-24683 National Lending Library for Science and Technology, Boston Spa (England).
ULTRASONIC ATTENUATION AND METHODS OF MEASURING IT
H.-D. Tietz 8 Feb. 1973 19 p refs Transl. into ENGLISH from Feingeratetechnik (East Berlin), v. 17, no. 12, 1968 p 570-571
(NLL-Risley-Tr-2571-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons CSCL 20A

The attenuation of the ultrasonic wave in ultrasonic tests is discussed in terms of obtaining information concerning the test specimen. The magnitude of the attenuation, and attenuation in different media are analyzed along with the techniques for measuring the attenuation. F.O.S.

N73-24684 National Lending Library for Science and Technology, Boston Spa (England).
THEORETICAL AND EXPERIMENTAL STUDY OF REFERENCE EQUIVALENT AND LOUDNESS LEVEL
K. Braun 9 Apr. 1973 19 p Transl. into ENGLISH from Telegraphen-, Fernsprech-, Funk- und Fernseh-Tech., v. 29, no. 2, 1940 p 31-57
(NLL-PO-2831-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The reference equivalent and loudness level are first examined theoretically. By measurements with random frequency mixtures and filters the indicating function of objective measuring equipments is compared with the loudness perception of the human ear. It is found that for the perception of the ear at high loudness levels, it is the root law and not the quadratic law of the measuring instrument which is valid. This means that there are some very important differences between the objective indicator and the subjective loudness perception of noises. Author

N73-24685 Purdue Univ., Lafayette, Ind.
ATTENUATION OF INFRARED RADIATION FROM A HEATED POROUS PLATE BY TRANSPIRATION OF AN ABSORBING GAS Ph.D. Thesis
David Hugh Quick 1972 130 p
Avail: Univ. Microfilms Order No. 72-30962

An analytical and experimental investigation of the attenuation of thermal radiation by transpiration of an absorbing gas is presented to study the effectiveness of shielding an environment from infrared radiation from a hot surface by the injection of an absorbing gas between the surface and the environment. The effect of an unheated starting length on the thermal radiation leaving a heated surface is also investigated. The two models considered in this investigation consisted of either a solid leading edge with a porous heated plate or a porous leading edge with a solid heated plate. The thermal radiation was measured and analyzed in selected spectral bands for both models.
Dissert. Abstr.

N73-24686 Polytechnic Inst. of Brooklyn, N.Y.
A THEORY OF CHIRPED OPTICAL PULSE PROPAGATION IN RESONANT ABSORBERS Ph.D. Thesis
Robert Anthony Marth 1972 186 p
Avail: Univ. Microfilms Order No. 72-28260

Frequency modulated (chirped) optical pulses, in the subpicosecond to microsecond pulse length range, are investigated. A new approximation technique involving a series expansion of powers of the electric field envelope is introduced and applied to a constant velocity (steady state) optical pulse propagation problem. Among the many results obtained is the first quantitative statement of the chirp present within steady-state optical pulses propagating in a resonant absorber. In addition, excellent agreement is obtained with previously reported expressions of the electric field envelope, the steady-state velocity, and the linear contribution to the wave number. Dissert. Abstr.

N73-24687 Stanford Univ., Calif.
SPACE-VARIANT IMAGE MOTION DEGRADATION AND RESTORATION Ph.D. Thesis
Alexander Andrew Sawchuk 1972 130 p
Avail: Univ. Microfilms Order No. 72-30694

A complete description of motion degradation in linear incoherent optical systems is presented. Given a mechanical description of motion between object and imaging system, an equivalent two-dimensional linear system is derived which includes all the motion-degradation effects. The system is space-variant in the general case in that each point in the object intensity distribution is blurred by an amount which varies with position to form the recorded image. A number of examples are discussed, including the space-invariant point-spread functions of planar object-image translation and space-variant cases of rotational motion and coordinate distortions. The effects of systems in cascade are treated and the motion and point-spread functions for general aerial imaging systems are derived in detail. Several a posteriori methods are given for restoring and enchancing images blurred by linear space-variant and invariant operations.
Dissert. Abstr.

N73-24688 Rochester Univ., N.Y.
THE DESIGN AND MEASUREMENT OF LOW ABSORPTANCE OPTICAL INTERFERENCE COATINGS Ph.D. Thesis
Gary William DeBell 1973 155 p
Avail: Univ. Microfilms Order No. 72-28741

A systematic design technique is developed to reduce the absorption in multilayer dielectric mirrors. Mirrors designed with this technique exhibit as much as 50 percent less absorption than conventional quarter wave stacks. The basic design consists of adjusting the thickness of the layers so the more absorbing of the two materials lies outside the regions of high standing wave electric fields in the multilayer. Low absorption mirrors consisting of quarter wave stacks modified in accordance with the low absorption design procedures were fabricated along with a control group of mirrors consisting of conventional quarter wave designs. Instrumentation was designed and built to measure and compare the absorption in these films. Also, a method is exhibited which allows the instrumentation to be used for measurement of the extinction coefficient of optical thin films.
Dissert. Abstr.

N73-24689 Rochester Univ., N.Y.
MODULATION TRANSFER PROPERTIES OF IMAGE FORMATION WITH PARTIALLY COHERENT LIGHT Ph.D. Thesis
Richard Joseph Becherer 1972 172 p
Avail: Univ. Microfilms Order No. 72-28724

Theoretical and experimental investigations of linear image formation with partially coherent light are reported. Linearization is achieved by restricting the object to small variations of amplitude transmittance and small variations of optical path. The diffraction theory of image formation is used to establish conditions for linearity and invariance. The two conditions of linearity and invariance permit a transfer function description of the relationship between object and image. Separate transfer functions describe

the imaging of amplitude variations and optical path variations of the object. The validity of the linear theory is examined theoretically by using objects consisting of sinusoidal amplitude transmittance variations. This is followed by a description of new conditions for invariance in imaging extended objects.
Dissert. Abstr.

N73-24690 Princeton Univ., N.J.
SCALAR QUANTUM FIELD THEORY IN A CLOSED UNIVERSE OF CONSTANT CURVATURE Ph.D. Thesis
Stephen Albert Fulling 1972 532 p
Avail: Univ. Microfilms Order No. 72-29783

Quantization of a massive neutral scalar field without self-interaction defined on a space-time manifold with given metric is studied, with emphasis on the two-dimensional de Sitter space. Applications in both general relativity and constructive quantum field theory are envisaged. The canonical formalism is developed for an arbitrary metric, and for special classes of metrics a Fock space can be constructed in analogy to the case of flat space. The relation of contraction between the irreducible unitary representations of the de Sitter group and those of the Poincare group of the same dimension is discussed in some detail. It is indicated that some arbitrariness can be removed from the treatment by considering concrete realizations of the representations by functions on the respective homogeneous spaces. The analogous case of three-dimensional rotation group and the Euclidean group of the plane is treated in an appendix.
Dissert. Abstr.

N73-24691 Polytechnic Inst. of Brooklyn, N.Y.
GUIDING AND SCATTERING OF ACOUSTIC SURFACE WAVES Ph.D. Thesis
Kuo-Hsiung Yen 1972 195 p
Avail: Univ. Microfilms Order No. 72-28306

The guiding and scattering of acoustic surface waves in solids have many potentially useful device applications. The use of a solid layer between two substrates is proposed as a means of coupling Rayleigh wave energy from one substrate to the other. The operating characteristics of a specific solid layer structure are predicted on the basis of a theoretical analysis of the guided wave properties of a solid layer between two semi-infinite substrates. A practical method, simple in both its theoretical design and practical implementation, is presented for highly efficient and broadband excitation of the thin ribbon waveguide.
Dissert. Abstr.

N73-24692 Stanford Univ., Calif.
THE EFFECT OF NEUTRON IRRADIATION ON REMANENT MAGNETIZATION IN IRON AND KAMACITE Ph.D. Thesis
Robert Franklin Butler 1972 105 p
Avail: Univ. Microfilms Order No. 72-30602

Natural remanent magnetization in Apollo 11 and 12 lunar samples and in most chondritic meteorites is carried by iron or kamacite. In order to determine whether cosmic-ray exposure is an important variable in formation of remanent magnetization in these rocks, the effects of proton and neutron irradiation on magnetic properties of iron and kamacite were investigated. Radiation damage theory indicates that the secondary fast neutron flux is more effective in producing lattice damage than is the primary proton flux. Two theoretical models of the effects of neutron irradiation on remanent magnetization and coercivity are developed. One model involves the pinning of domain walls by irradiation produced crystal defects. The preferred model involves the production of a uniaxial anisotropy by point defects introduced during irradiation.
Dissert. Abstr.

N73-24693*# National Academy of Sciences - National Research Council, Washington, D.C. Physics Survey Committee.
PHYSICS IN PERSPECTIVE, VOLUME 2. PART B: THE INTERFACES
1973 728 p refs
(Grant NSR-09-012-090)
(NASA-CR-132050; LC-72-84752-Vol-2-Pt-B; QC9.USN28-Vol-2-Pt-B; ISBN-0-309-02101-4) Avail: NTIS HC $38.50; Printing and Publishing Office, National Academy of Sciences, Washington, D. C. CSCL 12B

Detailed information of physics subfields and interface areas are presented. Topics discussed include: astrophysics and relativity, earth and planetary physics, physics in chemistry, physics in biology, instrumentation, education, and dissemination and use of the information of physics. For Vol. 1, see N72-28706; for excerpt from Vol. 1, see N72-29689; for Vol. 2, Pt. A, see N73-15706.
F.O.S.

N73-24694*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
X-RAY REFLECTION EFFICIENCY OF NICKEL-COATED QUARTZ OPTICAL FLATS
John M. Reynolds, Stanley A. Fields, and Robert M. Wilson 10 May 1973 25 p ref
(NASA-TM-X-64747) Avail: NTIS HC $3.25 CSCL 20F

The reflection efficiency of quartz optical flats vacuum coated with 1000-A nickel was evaluated. Of the three vacuum coated samples tested, two had been contaminated during the firing of the Lunar Module Reaction Control System in the vacuum chamber. Measurements were made for 1.54-, 1.79-, and 2.29-A incident radiation. The reflection efficiency of the contaminated samples was reduced by as much as 50 percent for some angles of incidence.
Author

N73-24695*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
LIGHT RAY TRACING THROUGH A LEAF CROSS SECTION
R. Kumar and L. Silva 1973 24 p refs
(Contract NGL-15-005-112)
(NASA-CR-132144; LARS-022373) Avail: NTIS HC $3.25 CSCL 20F

A light ray, incident at about 5 deg to the normal, is geometrically plotted through the drawing of the cross section of a soybean leaf using Fresnel's equations and Snell's law. The optical mediums of the leaf considered for ray tracing are: air, cell sap, chloroplast, and cell wall. The ray is also drawn through the same leaf cross section with cell wall and air as the only optical mediums. The values of the reflection and transmission found from the ray tracing tests agree closely with the experimental results obtained using a Beckman Dk-2A Spectroreflector.
Author

N73-24696# Lockheed Missiles and Space Co., Palo Alto, Calif.
ACCURACY OF CALCULATING L,B -COORDINATES
G. A. Trebukhovskaia, R. M. Golynskaia, and L. N. Osipova [1973] 6 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 11, no. 1, 1973 p 113-118
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

Errors in calculating the magnetic field intensity B and the parameter L of the invariant shell by a program complied for the BESM-4 electronic computer in machine codes, are analyzed. It was concluded that the maximum error is related to the accuracy of the representation for magnetic intensity at a given point in space by some system of coefficients in the series expansion of the geomagnetic field in spherical functions. A relative and absolute comparison of the diverse systems of coefficients are carried out.
Author

N73-24697# Lockheed Missiles and Space Co., Palo Alto, Calif.
HIGH-FREQUENCY SPECTUM DOMAIN OF TURBULENT JET NOISE
V. A. Krasilnikov and R. E. Shikhlinskaia [1973] 3 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 3: Fiz-Astron. (Moscow), v. 12, no. 5, 1972 p 626-628
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

The expression for the dependence of the noise power spectral density on the radiation frequency is found by using similarity and dimensional analysis. The expression is then used to find the high frequency part of the turbulent jet noise spectrum where viscosity is essential.
F.O.S.

N73-24698# Syracuse Univ., N.Y. Dept. of Physics.
NON-RENORMALIZABLE INTERACTIONS AS LOW-ENERGY LIMITS OF RENORMALIZABLE ONES
F. Rohrlich May 1973 8 p refs Sponsored by NSF
Avail: NTIS HC $3.00

The interactability of nonrenormalizable relativistic quantum field theories are studied in a model of a Dirac particle in interaction

with a neutral pseudoscalar particle. Starting with the field equations for the commutation relations, and the boundary conditions, the renormalizable theory lower limits are derived.
F.O.S.

N73-24699# Syracuse Univ., N.Y. Dept. of Physics.
NULL PLANE QUANTUM ELECTRODYNAMICS
F. Rohrlich and J. H. TenEyck [1973] 6 p refs
Avail: NTIS HC $3.00

Covariant Feynman rules are given which permit calculations in null plane quantum electrodynamics (NQED) as easily as in the conventional theory. The equivalence between NQED and the standard Feynman-Dyson formulation is discussed. Author

N73-24700*# Scientific Translation Service, Santa Barbara, Calif.
THE THEORY OF HORIZONTAL VISUAL RANGE
H. Koschmieder Washington NASA Jun. 1973 36 p refs Transl. into ENGLISH from Beitr. zur Physik der freien Atmosphaere (West Ger.), v. 12, 1924 p 33-35
(Contract NASw-2483)
(NASA-TT-F-14930) Avail: NTIS HC $4.00 CSCL 20F

An analytical representation is given of the brightness of a black body. The brightness integral is evaluated with the aid of the observed sky brightness. The limits of validity of the expressions derived are presented. Author

N73-24701*# Avco-Everett Research Lab., Everett, Mass.
ION STREAMING INSTABILITIES WITH APPLICATION TO COLLISIONLESS SHOCK WAVE STRUCTURE
Kenneth I. Golden, Lewis M. Linson, and Siva A. Mani Mar. 1973 27 p refs
(Contract NASw-2302)
(NASA-CR-132953; Avco-Everett-Res-Rept-383) Avail: NTIS HC $3.50 CSCL 20C

The electromagnetic dispersion relation for two counterstreaming ion beams of arbitrary relative strength flowing parallel to a dc magnetic field is derived. The beams flow through a stationary electron background and the dispersion relation in the fluid approximation is unaffected by the electron thermal pressure. The dispersion relation is solved with a zero net current condition applied and the regions of instability in the k-U space (U is the relative velocity between the two ion beams) are presented. The parameters are then chosen to be applicable for parallel shocks. It was found that unstable waves with zero group velocity in the shock frame can exist near the leading edge of the shock for upstream Alfven Mach numbers greater than 5.5. It is suggested that this mechanism could generate sufficient turbulence within the shock layer to scatter the incoming ions and create the required dissipation for intermediate strength shocks. Author

N73-24702# European Organization for Nuclear Research, Geneva (Switzerland).
OPTICAL CONCEPTS IN HIGH ENERGY PHYSICS
K. Gottfried 17 Nov. 1972 30 p refs
(CERN-72-20) Avail: AEC Depository Libraries

The eikonal approximation for scatterings by potential at high energy, elastic scattering by deuterium, the optical model for elastic scattering, and coherent photoprocesses in nuclei are examined. NSA

N73-24703# Maryland Univ., College Park.
MAGNETIC STRUCTURE OF RbMnBr3
C. J. Glinka, V. J. Minkiewicz, D. E. Cox (bnl), and C. P. Khattak (bnl) 1972 5 p refs Presented at 18th Ann. Conf. on Magnetism and Magnetic Materials, Denver, Colo., 28 Nov. 1972 Sponsored by NSF and AEC
(BNL-17519; Conf-721114-17) Avail: NTIS

The magnetic properties of the CaNicl3-type compound RbMnBr3 were studied by powder neutron diffraction and susceptibility measurements. Below T sub N = 8.8 + or - 0.1 K, the compound exhibits antiferromagnetic order. The Mn(+2) moments lie parallel to the basal plane of the hexagonal lattice and form antiferromagnetic chains along the c axis. In the basal plane the spins form a spiral which differs from the simple triangular arrangement found in other compounds of this type in that the turn angle is about 130 deg rather than 120 deg. The Mn(+2) moment extrapolated to 0 K is 3.6 + or - 0.15 microbarns. This large reduction in the magnetic moment is believed to reflect strong zero-point spin wave deviation. Similar reduction of the Ni(+2) moment was observed in CsNiCl3 and RbNiCl3. Author

N73-24704# Institute of Mathematical Science, Madras (India).
LECTURES ON THE THEORY OF QUANTUM FLUIDS
R. Sridhar 1972 95 p refs
(MATSCIENCE-73) Avail: AEC Depository Libraries

The physics of quantum fluids is discussed. Topics discussed include: Bose statistics and liquid H4, Landau's theory, and attempts to quantize fluid flow. F.O.S.

N73-24705# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
RULED GRATINGS FOR X-RAY AND FAR ULTRAVIOLET SPECTRA Final Report, 1 Oct. 1969 - 30 Sep. 1972
J. Alvin Bearden 28 Dec. 1972 31 p refs
(Contract F19628-70-C-0070; AF Proj. 6688)
(AD-757894; AFCRL-TR-73-0050) Avail: NTIS CSCL 20/6

A brief resume is presented of The Johns Hopkins University's involvement in the development of seven diffraction ruling engines dating from Rowland 1881 to the present. A review of the literature indicates that many of the experimental limitations in the X-ray and far ultraviolet were due to shadowing mounds at the edge of each ruled line. Blazing, if carefully controlled, is effective in the longer ultraviolet but not in the X-ray region. A new process for making ruled gratings is described which eliminates the mounds that are so effective in destroying the diffracted intensity when the grating is used at small glancing angles as in X-rays. With close control of the ratio of the flat to groove width, one should be able to make a grating which maximizes intensity for a desired order and minimizes it for other selected neighboring orders. Technical details on various parts of the process are described. (Author Modified Abstract)
GRA

N73-24706# Tracor, Inc., Austin, Tex.
AN EXACT SHOCK WAVE SOLUTION TO BURGER'S EQUATION FOR PARAMETRIC EXCITATION OF THE BOUNDARY
Boyd B. Cary, Jr. Apr. 1973 29 p refs
(Contract N00014-73-C-0202; TRACOR Proj. 025-005)
(AD-758409; TRACOR-T-73-NJ-4001-U) Avail: NTIS CSCL 20/1

Using the saddle point method of integration an exact plane wave solution for Burger's equation has been found in the shock zone when the boundary is either driven sinusoidally at two different frequencies and amplitudes or by an amplitude modulated sinusoid. The solution can be extended to the spherical case. This result can be useful in predicting extra loss for parametric arrays operating with shock formation in the near field.
Author (GRA)

N73-24707# California Univ., La Jolla. Dept. of Physics.
THEORY OF METAL SURFACES: INDUCED SURFACE CHARGE AND IMAGE POTENTIAL
Norton Lang and Walter Kohn Mar. 1973 40 p refs
(Contract N00014-69-A-0200-6026; NR Proj. 017-653)
(AD-758380; TR-16) Avail: NTIS CSCL 20/3

The paper contributes to the theory of the electron density distribution induced at a metal surface by a small static external charge distribution. As a first application, profiles of the charge induced by a uniform external electric field are obtained for metals of different bulk electron densities. A quantity of particular interest is the position of the center of mass, xo, of these profiles, for which present numerical values are given. (The x-axis is taken along the surface normal). Next, the case of a small point charge, q, with x-coordinate x1 well outside the surface, is treated. The authors locate x(o), the effective position of the metal surface, relative to the last lattice plane of the crystal. They also discuss the implications of these results for alkali adsorption on metal substrates, the capacitances of small-gap condensers, and field-emission experiments. Author (GRA)

N73-24708# Yeshiva Univ., New York. Belfer Graduate School of Science.
STATISTICAL MECHANICS FOR CALCULATION OF

THERMAL, MAGNETIC, ELECTRICAL AND MECHANICAL PROPERTIES OF MATERIALS Final Report, 1 Oct. 1970 - 30 Sep. 1972
J. L. Lebowitz Nov. 1972 44 p refs
(Contract F44620-71-C-0013; AF Proj. 9767)
(AD-758257; AFOSR-73-0526TR) Avail: NTIS CSCL 07/4

The work covers the whole field of statistical mechanics including both equilibrium and non-equilibrium phenomena. The aim of statistical mechanics is to relate the properties of materials to the properties of the atoms and molecules out of which these materials are made up. The end product of the work is a better understanding and thus better control of the thermal, magnetic, electrical and mechanical properties of macroscopic matter. (Author Modified Abstract) GRA

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N73-24709*# Texas A&M Univ., College Station. Engineering Experiment Station.
EVALUATION OF RADIOISOTOPE TRACER AND ACTIVATION ANALYSIS TECHNIQUES FOR CONTAMINATION MONITORING IN SPACE ENVIRONMENT SIMULATION CHAMBERS Final Report
J. B. Smathers, W. E. Kuykendall, Jr., R. E. Wright, Jr., and J. R. Marshall 1 Apr. 1973 108 p refs
(Contract NAS9-12586)
(NASA-CR-128931) Avail: NTIS HC $7.50 CSCL 20H

Radioisotope measurement techniques and neutron activation analysis are evaluated for use in identifying and locating contamination sources in space environment simulation chambers. The alpha range method allows the determination of total contaminant concentration in vapor state and condensate state. A Cf-252 neutron activation analysis system for detecting oils and greases tagged with stable elements is described. While neutron activation analysis of tagged contaminants offers specificity, an on-site system is extremely costly to implement and provides only marginal detection sensitivity under even the most favorable conditions. Author

N73-24710# Syracuse Univ., N.Y. Dept. of Physics.
THE FIRST THEORY OF AN ELEMENTARY PARTICLE: HISTORY AND PRESENT STATE OF THE THEORY OF THE ELECTRON
F. Rohrlich 25 Sep. 1972 80 p refs Presented at Symp. on the Develop. of the Physicist's Conception of Nature, Trieste, Italy, 18-25 Sep. 1972
Avail: NTIS HC $6.00

The development of the first elementary particle theory is traced up to its present state. The classical theory is reviewed for its limitations imposed by relativistic quantum mechanics. An alternative to describing the mass of electrons within the framework of the classical theory is projected; this method proposes that Coulomb self-interaction does not exist and that there is no electromagnetic self-energy. G.G.

N73-24711# National Research Council of Canada, Ottawa (Ontario).
THERMAL QUENCHING OF LUMINESCENCE AND CONFORMATIONAL TRANSFORMATIONS IN MACROMOLECULES OF SOME POLYMERS
E. V. Anufrieva, V. A. Samokish, I. N. Serdyuk, and V. E. Eskin 1973 9 p refs Transl. into ENGLISH from Vysokomol. Soedin., Ser. B (USSR), v. 11, no. 2, 1969 p 114-117
(NRC-TT-1631) Avail: NTIS HC $3.00

The thermal quenching of luminescence of poly beta-naphthylmethacrylate), poly (beta-vinyl naphthalene), and beta-methyl naphthalene was investigated in the visible region of the spectrum of polymer solutions and in the temperature range including that of conformational transformation in macromolecules. It was shown that the effect of thermal quenching of luminescence is highly sensitive to the conformational state of macromolecules. Author

N73-24712*# Scripta Technica, Inc., Washington, D.C.
INVESTIGATION OF THE COLLISION OF METASTABLE ATOMS OF He(2 3S) WITH MOLECULES OF N2 AND O2
A. P. Kalinin and V. B. Leonas NASA Jun. 1973 12 p refs Transl. into ENGLISH of "Issledovaniye Stolknoveniy Metastabilnykh Atomov He (2 3S) s Molekulami N2, O2", Acad. of Sci., USSR, Inst. for Space Res., Moscow, report Pr-126, 1972 16 p
(Contract NASw-2484)
(NASA-TT-F-14801; Pr-126) Avail: NTIS HC $3.00 CSCL 20H

The results are presented of a study of the differential scattering of He atoms in the (1 4S) and (2 3S) states in oxygen and nitrogen. The experimental data are treated using an additive model of the interaction potential, and the parameters of the potential are found. It is observed that the scattering of metastable atoms of He (2 3S) in oxygen and nitrogen is less well described by the given potential model than that of He atoms in their lowest energy state. The results obtained are discussed. Author

N73-24713# Massachusetts Inst. of Tech., Cambridge.
THERMAL NEUTRON SCATTERING STUDIES OF MOLECULAR DYNAMICS AND CRITICAL PHENOMENA IN FLUIDS AND SOLIDS Annual Progress Report, Dec. 1971 - Nov. 1972
S. H. Chen 1972 7 p refs
(Contract AT(11-1)-3352)
(COO-3352-4) Avail: NTIS

The application of neutron inelastic scattering spectroscopy to basic problems in materials science, particularly quasielastic scattering at low energies, is discussed. An analysis was also made of the resolution function for making accurate corrections of instrumental resolution broadining. Measurements were made of hydrogen gas from 85 K to 300 K, pressures ranging up to 5000 psi, and liquid gallium above and below the melting point. Author (NSA)

N73-24714# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
LIQUID-HYDROGEN MODERATOR: CHANNEL H5 EL 3
G. DerNigohossian Nov. 1972 95 p refs In FRENCH
(CEA-N-1571) Avail: AEC Depository Libraries

Following a summary of the principles of low temperature neutron moderators, the construction and operation of a liquid hydrogen cold neutron source which is used in the channel H5 of the EL 3 reactor at Saclay is described. The use of thermally induced hydrogen circulation and of a Philips gas refrigerator results in important simplifications and increased safety compared to existing systems. The problems met and the techniques employed are described. Author (NSA)

N73-24715# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Physik-Inst.
NEUTRON SCATTERING: A METHOD FOR INVESTIGATION OF THE FLUID STATE OF MATTER
O. J. Eder Nov. 1972 24 p refs In GERMAN
(SGAE-2054) Avail: AEC Depository Libraries

Mathematically treated is the scattering of thermal neutrons as a tool for studying the liquid state of matter. In this state, microscopic molecular motion cannot be extrapolated from the dynamics of either solid bodies or gases. At the present time, no simple model exists for the liquid state, such as the ideal or Boltzmann's gas for the gaseous state, or the thermonic crystal for the solid state. The hard core approximation explains many macroscopic and microscopic properties. A comprehensive theory of the liquid state, however, must take into account a more precise treatment of the potentials between particles. NSA

N73-24716# Bhabha Atomic Research Centre, Bombay (India). Metallurgy Div.
FABRICATION OF PLUTONIUM-BERYLLIUM NEUTRON SOURCES
V. K. Mahajan, C. Ganguly, M. S. Ramakumar, P. R. Roy, and V. K. Moorthy 1972 16 p refs
(BARC-629) Avail: AEC Depository Libraries

The various fabrication steps employed in the production of 22 plutonium-beryllium neutron sources of varying strengths are described. NSA

N73-24717# Colorado Univ., Boulder. Dept. of Physics.
THE THIRD INTERNATIONAL CONFERENCE ON ATOMIC PHYSICS Final Report
Stephen J. Smith 7 Mar. 1973 12 p ref
(Grant AF-AFOSR-2382-72; AF Proj. 9767)
(AD-757890; AFOSR-73-0501TR) Avail: NTIS CSCL 07/4

The Conference was held at Boulder, Colorado, August 7-11, 1972. About 300 Scientific leaders and selected students gathered for a week of discussion of fundamental atomic and molecular physics, of important new techniques which have been developed, and of a few of the more significant applications to other fields. Author (GRA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N73-24718 Michigan Univ., Ann Arbor.
LASER INTERACTION WITH A HIGH DENSITY LITHIUM PLASMA Ph.D. Thesis
Thomas Allen Leonard 1972 137 p
Avail: Univ. Microfilms Order No. 72-29131

A thin lithium wire was extruded and exploded in a vacuum and the resulting plasma was studied during the first two microseconds of the discharge. Included in the study were the scattering of a Q-switched ruby laser beam, high speed streak photographs showing the laser-plasma interaction, and time-resolved emission spectra. The wire diameter of 0.0025 cm coupled with an initial current rise of 5 x 10 to the 10th power amp/sec. led to complete ionization of the wire within 100 nanoseconds. The scattering process was dominated by Fresnel reflection at the vacuum-plasma interface. This was verified by streak photographs which showed that the interaction normally occurred at the edges of the plasma column. The electron density calculated from mass conservation varied from 10 to the 17th power to 10 to the 19th power/cu cm as the plasma column oscillated in diameter. These densities matched those obtained from the Fresnel reflection model very well. Dissert. Abstr.

N73-24719 Michigan Univ., Ann Arbor.
IONIZATIONAL RELAXATION IN SHOCK-HEATED MERCURY VAPOR Ph.D. Thesis
James Harvey Dell 1972 106 p
Avail: Univ. Microfilms Order No. 72-29028

Various aspects were investigated of the ionizational relaxation in a shock-heated mercury plasma. A uniformly heated, pressure-driven shock tube was used to produce 4200 K to 12,000 K mercury plasmas in which the relaxation process was studied. The total plasma luminosity was observed using a photomultiplier tube, with the time of shock passage and the shock velocity established using a Schlieren optical system. It is shown that the ionizational relaxation time depends inversely on the initial vapor pressure or atom number density, and directly on the final electron number density. The final plasma temperature is shown to be more relevant for strongly ionized shocks than the commonly used ideal gas temperature. Ionizations caused by electron-atom collisions appear to occur as a single step rather than by cumulative steps as atom-atom collision ionizations. Dissert. Abstr.

N73-24720 Oklahoma Univ., Norman.
FORCES AND ENERGY TRANSFER INDUCED BY RAREFIED PLASMA FLOWS PAST SOLID BODIES Ph.D. Thesis
Chia-Han Liu 1972 112 p
Avail: Univ. Microfilms Order No. 72-29897

An analytic investigation was made of the problem of determining the electric potential field and the aerodynamic moments for a steady rarefied plasma flow past a sphere by means of the Vlasov-Poisson set of equations. The equations are attached by means of a perturbation method exploiting the features of an ionospheric satellite, i.e., the velocity of the satellite is much larger than the thermal velocity of ions, but much smaller than that of electrons, and the Debye length is much smaller than the characteristic length of the satellite. The electric potential, especially in the vicinity of the sphere, was examined. This part of the investigation gives the nature of the electric field and provides a number of useful approximate formulas including the one for the Maxwell drag. The first-order approximation to the ion distribution function is obtained for the special case of a spherical potential, which is suitable for the sphere problem. The first-order approximate expressions of floating potential, slip velocity, molecular drag, and energy transfer are obtained as a function of the ion speed ratio, surface potential, and the Debye length. Dissert. Abstr.

N73-24721 Michigan Univ., Ann Arbor.
TWO STUDIES IN MAGNETOHYDRODYNAMICS: CONCERNING INSTABILITY AND SOLITARY WAVES Ph.D. Thesis
Chung-Yi Wang 1972 124 p
Avail: Univ. Microfilms Order No. 72-29234

In the first problem, the stability of a viscous, incompressible, conducting fluid with finite electric conductivity is considered. The chief purpose of this study is to demonstrate that a discontinuity in electric conductivity can cause instability under the combined action of an electric current and a superimposed magnetic field normal to it. An eigenvalue problem governing the stability of the fluid is formulated for infinitesimal disturbances. The eigenvalues obtained are used to determine the stability or instability of the flow. In the second part of the work, solitary waves of finite amplitude and permanent form in an inviscid, incompressible conducting fluid between two concentric cylinders are investigated. Equations governing the displacement of stream surface subjected to axisymmetric disturbances are solved by a perturbation method. Long waves with infinitesimal amplitude are obtained from the first-order approximation while solitary wave solutions are obtained from the second-order approximation. Dissert. Abstr.

N73-24722# Nagoya Univ. (Japan). Inst. of Plasma Physics.
THEORETICAL ANALYSIS OF ION CYCLOTRON WAVES
Kiyokata Matsuura and Hiroshi Toyama Feb. 1973 63 p refs
(IPPJ-150) Avail: NTIS HC $5.25

Dispersion and energy relations of ion cyclotron wave for a cold plasma are systematically studied retaining the electron mass. In this case, two wave modes having different perpendicular wave numbers can exist in a uniform plasma column. The dominant mode is a quasi-TE mode, in which the plasma current j sub z is an important quantity. Because this current is carried by electron motion along the static magnetic field, the dispersion relation and energy relations are considerably modified for light mass ions compared with the customary one in which the electron mass is neglected. Plasma loading for a coil excitation of the Stix type is also considered using this dispersion relation. The electric field, magnetic field, energy density, and energy flow are calculated based on the quasi-TE mode. The energy losses due to cyclotron damping and collisions are also summarized. Here a possible mechanism due to resistivity is pointed out. Author

N73-24723# Nagoya Univ. (Japan). Inst. of Plasma Physics.
EXPERIMENTS ON ION-ACOUSTIC SOLITARY WAVES
H. Ikezi Jan. 1973 38 p refs
(IPPJ-149) Avail: NTIS HC $4.00

Ion-acoustic solitary waves (Solitons) were studied experimentally by employing a double plasma device. The solitary waves are found to be produced from both a single compressional pulse and a continuous wave. A rarefaction pulse also produces solitons if the pulse width is sufficiently wide. A theory based on the Schrodinger equation accounts for the number of solitons. Recurrence to the original state is observed when a continuous wave is launched. A simple wave-wave coupling analysis for the recurrence of the original state is given. Author

N73-24724# Nagoya Univ. (Japan). Inst. of Plasma Physics.
[PLASMA PHYSICS RESEARCH] Annual Review, April 1971 - March 1972
Mar. 1972 166 p refs
Avail: NTIS HC $10.50

Research activities in plasma physics are reported for this period. Topics discussed include: toroidal confinement of low beta plasma, pinch plasmas, RF plugging and heating, plasma heating, dynamic stabilization, plasma production, and thermonuclear fusion by laser. Lists of published articles and reports for this period are included. F.O.S.

N73-24725*# Princeton Univ., N.J. Guggenheim Aerospace Propulsion Lab.
PULSED ELECTROMAGNETIC ACCELERATION Semiannual Report
Robert G. Jahn, Woldemar F. VonJaskowsky, and Kenn E. Clark Jan. 1973 117 p refs
(Grant NGL-31-001-005)
(NASA-CR-131270; SAR-634t) Avail: NTIS HC $8.00 CSCL 20I

Direct measurements of the power deposited in the anode of a multimegawatt MPD accelerator using thermocouples attached to a thin shell anode reveal a dramatic decrease in the fractional anode power from 50% at 200 KW input power to less than 10% at 20 MW power. The corresponding local power flux peak at a value of 10,000 W/sq cm at the lip of the anode exhaust orifice, a distribution traced to a corresponding peak in the local current density at the anode. A comparison of voltage-current characteristics and spectral photographs of the MPD discharge using quartz, boron nitride and plexiglas insulators with various mass injection configurations led to the identification of different voltage modes and regions of ablation free operation. The technique of piezoelectric impact pressure measurement in the MPD exhaust flow was refined to account for the effects due to probe yaw angle. Author

N73-24726# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
INFLUENCE OF ATOM-ATOM COLLISIONS ON ELECTRON DENSITY DECAY IN LASER-PRODUCED HELIUM PLASMAS
H. W. Drawin 1972 96 p refs Presented at 6th Yugoslav Symp. and Summer School on the Phys. of Ionized Gases, Split, Yugoslavia, 16 Jul. 1972
(CEA-CONF-2102; Conf-720729-1) Avail: AEC Depository Libraries

Theoretical and experimental work on recombination coefficients is described. A non-LTE model was used to calculate the collisional-radiative volume recombination and ionization coefficients for helium plasmas. The experimental part consisted of determining the volume decay coefficient for laser-produced helium plasmas. NSA

N73-24727# Sydney Univ. (Australia). Wills Plasma Physics Dept.
[RESEARCH PROGRESS IN PLASMA SOURCES, SHOCK WAVES, CYCLOTRONS, AIR POLLUTION, AND LASER DIAGNOSTICS] Progress Report, 1 Jul. - 31 Dec. 1972
1972 10 p refs
(NP-19643; MPR-24) Avail: AEC Depository Libraries

Summaries are given of experimental progress in plasma sources, hydromagnetic shock waves, rotating plasmas, ion cyclotrons, cyclotron harmonic waves, far-infrared, atmospheric pollution and laser diagnostics. Author (NSA)

N73-24728# Oak Ridge National Lab., Tenn.
INTERCHANGE STABILITY OF A GUIDING-CENTER PLASMA IN AN AXISYMMETRIC MAGNETIC TRAP
G. E. Guest, C. L. Hedrick, and D. B. Nelson Dec. 1972 29 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4077) Avail: NTIS

The present case involves two important simplifying restrictions: (1) Because of the assumed symmetry, an orthogonal curvilinear coordinate system based on the magnetic field lines is used. The properties of this reference frame are summarized. (2) Because of the restriction to interchange modes' useful stability criteria was obtained without solving the the full Euler-Lagrange minimization problem. Interchanges are defined to be perturbations that leave the shape of magnetic field lines unchanged; that is, the perturbed magnetic field is parallel to the equilibrium field. Since closely related criteria were derived earlier for scalar pressure plasmas (in closed-line devices), a brief derivation of the scaler-pressure criterion is given, and its correspondence with the present guiding-center criteria is discussed. Author (NSA)

N73-24729# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
MICROINSTABILITIES IN INHOMOGENEOUS PLASMA Progress Report, 31 Jan. 1972 - 31 Jan. 1973
T. Kammash Jan. 1973 6 p refs
(Contract AT(11-1)-1478)
(COO-1478-13) Avail: NTIS

Summaries are given of research topics. Data cover the following: (1) two-dimensional investigation of absolute instabilities of mirror plasmas, (2) beam-plasma interaction in Astron, (3) energy loss of charged particles in Maxwellian plasma, (4) slowing down of relativistic electrons in plasma, (5) anomalously confined Tokamak reactor, and (6) alpha particle heating of mirror plasmas. NSA

N73-24730# Stanford Univ., Calif. Inst. for Plasma Research.
RESEARCH INTO AND USE OF COMPUTER MODELS OF PLASMAS IN CONTROLLED THERMONUCLEAR RESEARCH Technical Report, 1 Dec. 1972 - 30 Nov. 1973
Sep. 1972 17 p refs
(Contract AT(04-3)-799)
(SU-799-X-1; IPR-1-73) Avail: NTIS

Current research on simulation of fusion devices is briefly described. Computer experiments are discussed in particular. Summaries are given for the following studies: (1) A propagation experiment with a three-dimensional electromagnetic code which minimizes interpolation effort and proceeds entirely in x, y, z space; (2) optimization of a fast Fourier transform code to permit working in transform space for achieving better quality, (3) comparison of two relativistic Lagrangian particle codes, (4) an electrostatic experiment in log r, theta z geometry which will be used for toroidal devices; (5) studies of resolution by spline interpolation, (6) optimization of interpolation by means of the variational principle, and (7) experiments with Eulerian codes. NSA

N73-24731# California Univ., Berkeley. Coll. of Engineering.
HEATING OF MAGNETIZED PLASMAS BY A LARGE-AMPLITUDE LOW-FREQUENCY ELECTRIC FIELD
Liu Chen and C. K. Birdsall Jun. 1972 63 p refs
(Contract AT(11-1)-34)
(UCB-34-P-128-X-3; ERL-352) Avail: NTIS

Plasma electron and ion heating due to a large amplitude oscillating electric field E sub omicron applied normal to a steady magnetic field B sub omicron was followed in detail by one-dimensional computer simulation. The large oscillating drift velocity (E sub omicron/B sub omicron greater than v sub e) at low frequencies sets up instabilities due to the periodic electron E/B drift through the ions, which then cause rapid heatings. For waves propagating across the instability there is a Buneman-type upper hybrid two-stream instability. For oblique propagating waves, there is an additional instability, the modified two-stream instability. Strong ion (perpendicular) heating also occurs with the ion thermal velocity at wave saturation. Comparison with similar work with B sub omicron = zero shows that addition of B sub omicron is best for ion heating. Author (NSA)

N73-24732# Columbia Univ., New York.
EXPERIMENTAL RESEARCH ON HIGH BETA PLASMA Technical Progress Report, 1 May 1972 - 30 Apr. 1973
R. A. Gross 15 Jan. 1973 5 p refs
(Contract AT(11-1)-2233)
(COO-2233-1) Avail: NTIS

Three research topics on high Beta, hot, dense plasma were studied experimentally, including: (1) study by laser-scattering techniques of the temperature and density distributions of the shock-wave-heated plasma in the Columbia high-energy shock tube; (2) study of the rate of energy transfer between a hot, dense plasma containing a strong magnetic field and a cold metallic wall in the Columbia high-energy shock tube; and (3) study of the absorption and scattering of 10.6-micron(CO_2 laser) radiation from a hot, dense plasma created by a plasma focus device. Author (NSA)

N73-24733# Cornell Univ., Ithaca, N.Y. Lab. of Plasma Studies.
PROPOSAL TO STUDY ION RESONANCE HEATING OF PLASMA Final Report, 1 Jan. - 31 Dec. 1972
P. Korn and C. B. Wharton [1973] 31 p refs
(Contract AT(11-1)-2194)
(COO-2194-1) Avail: NTIS

The mechanism responsible for RF plasma heating in the Cornell turbulently preheated mirror machine was identified as fundamental and harmonic resonant ion cyclotron heating. Observation of the neutral atom flux emitted from a localized region of plasma using a highly directional detector shows the heating to be sharply resonant with magnetic field and occurring well outside the near field of the antenna. Experiments on microwave scattering from the plasma waves also show the resonant behavior with significant increases in fluctuation level at twice the driving RF frequency for long wavelengths. This is highly suggestive of an electrostatic heating mechanism in the resonance region. A detailed investigation of the energy balance determined that the plasma diamagnetism increases linearly with RF power up to 1 MW, with no saturation effects evident. NSA

N73-24734# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
STABILIZATION BY SHEAR OF DRIFT INSTABILITIES
M. Gregoire and P. Rolland Aug. 1972 44 p refs In FRENCH; ENGLISH summary Sponsored by EURATOM
(EUR-CEA-FC-646) Avail: AEC Depository Libraries

Stabilization by shear of the dissipative drift instabilities in a linear hard core configuration with a hydrogen plasma was studied. In the pressure range considered, the plasma is dominated by collisions between neutral particles. A theory is developed which takes into account these types of collision and the parallel ion motion. The spatial structure of the modes and the functional dependence of the stabilization on the B(z), pressure, and shear parameters are systematically analyzed using correlation methods. In the presence of a shear, the waves retain their usual drift wave structure. Their radial structure is essentially that of the lowest normal mode. The stabilizing effect of the magnetic field is quantitatively explained by the theory and demonstrates the importance of the parallel ion motion. NSA

N73-24735# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Technische Physik.
APPLIED MAGNETOHODYRODYNAMICS. VOLUME 9: CALCULATION OF THE CHARACTERISTIC QUANTITY OF THE WORKING GAS OF THE MHD-COMBUSTION GAS GENERATOR
W. D. Kuehne and G. Kolb 1972 124 p refs In GERMAN
(JUL-874-TP-Vol-9) Avail: AEC Depository Library

The thermodynamic and electric properties of working fluid of the MHD-combustion gas generator are described. Three practically important gaseous fuels: natural gas, coke gas, and propane were studied. First, the composition of the combustion gas is calculated which yields, from the basic energy balance equation, the adiabatic flame temperature. Subsequently the entropy, specific heat, enthalpy, density, isotrope exponent, electric conductivity, and the Hall parameter are calculated. The composition of combustion gases, flame temperature, and the other factors are presented in numerous diagrams as functions of various operational parameters, such as stoichometry and degree of oxygen enrichment in the oxidator. The concentration of the seed material was consistently assumed to be 1% in weight. NSA

N73-24736# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
THEORETICAL AND EXPERIMENTAL STUDY OF INSTABILITIES DUE TO ANISOTROPY IN A HOT ELECTRON PLASMA Ph.D. Thesis - Paris Univ. [ETUDE THEORIQUE ET EXPERIMENTALE DES INSTABILITIES D'ANISOTROPIE DANS UN PLASMA D'ELECTRONS CHAUDS]
J. Jacquinot Oct. 1972 207 p refs In FRENCH; ENGLISH summary
(EUR-CEA-FC-664) Avail: AEC Depository Libraries

A theoretical and experimental study of the anisotropy-produced instabilities that can develop in a mirror-confined hot-electron plasma is presented. From the solution of the Vlasov equation in an infinite medium it is deduced that the most unstable modes are: the electromagnetic waves propagating along the field lines, and the oblique electrostatic waves. In order to explain the experimental results, it was found necessary to include in the theoretical analysis the effects of the loss cone, relativistic mass variation, and cold plasma. The hot electron plasma (mean energy 15 keV) which is confined in the magnetic well of the BET experiment exhibits three confinement regimes: at low density the plasma is stable, the plasma radiation is thermal, and the confinement time is fully explained by a collision angular diffusion theory; when the density exceeds a critical value, a high-amplitude instability develops and produces considerable diffusion into the loss cone; and at intermediate densities no anomalous losses are detectable. NSA

N73-24737# European Space Research Inst., Frascati (Italy).
TOWARDS ABSOLUTE IONIC EXCITATION CROSS-SECTIONS BY ELECTRON IMPACT ON LASER-PRODUCED PLASMAS
G. A. Proca Paris ESRO Dec. 1972 58 p refs
(ESRO-SN-122) Avail: NTIS HC $5.00

A feasibility study of an experiment is presented. By crossing a laser-produced plasma beam with an electron beam, ionic excitation cross-sections for highly stripped ions can be obtained through measurement of the energy loss of inelastically scattered electrons. Where absolute measurement can be performed, the conditions for which are indicated, the precision would be 27 percent, whereas relative measurements can be performed with a precision of 4 percent. The main limitation of the experiment is shown to be due to two-stream instability thus requiring a high-power high-repetitivity laser (CO2 300 MW, 100 cps). The relevance of the proposed experiment to space oriented atomic physics is stressed and immediate astrophysical applications are indicated. Author (ESRO)

N73-24738# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Plasma Physics Research Lab.
EFFECTS OF ELECTRON TEMPERATURE VARIATIONS ON SPECTRAL LINE INTENSITY RATIOS Final Technical Report
R. F. Weber Feb. 1973 134 p refs
(AF Proj. 7073)
(AD-758232; ARK-73-0001) Avail: NTIS CSCL 20/9

Time-varying a.c. arcs or positive columns are used in discharges in gas mixtures, especially laser discharges and a dc discharge may spontaneously support oscillations or turbulence. An analysis is made of the errors that arise in line-intensity measurements due to the experimental averaging of the time-varying intensities caused by electron-temperature fluctuations in continuous plasma sources. These calculations are applicable for both periodic and for random electron-temperature fluctuations. A method, which is shown to be subject to less error, is to use a polychromator and to measure the average of the instantaneous line-intensity ratio. The results are presented in a series of graphs in both dimensional and non-dimensional form to cover the parameter space of interest in the diagnostics of most turbulent plasmas. (Author Modified Abstract) GRA

N73-24739# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
RESEARCH DIRECTED TOWARD EXPERIMENTAL INVESTIGATION OF ELECTROPHORESIS IN PLASMAS Final Report, 15 Oct. 1969 - 15 Dec. 1972
L. M. Chanin Dec. 1972 112 p refs
(Contract F19628-70-C-0075; AF Proj. 8659)
(AD-757886; AFCRL-72-0715) Avail: NTIS CSCL 20/9

The report summarizes the results of studies of certain phenomena which occur in dc gas discharges. Emphasis has been placed on the experimental determination of the relative ionic species present in dc capillary discharges for the noble gases. The reliability and theoretical interpretation of these results is considered. Techniques are discussed which enable ion sampling measurements to be made in the presence of striations. Longitudinal pressure gradient studies have been conducted in the same apparatus as used for ion sampling. Cataphoresis measurements using ion sampling techniques have been performed in He-N2 mixtures. Ion sampling methods applied to Xe-Hg mixtures indicate the presence under certain conditions of a variety of complex ions. Author (GRA)

N73-24740# Institute for Defense Analyses, Arlington, Va. Jason Div.
TWO STREAM COUPLING OF CORONA AND CORE IN LASER HEATED PELLETS
Thomas M. ONeill and Marshall N. Rosenbluth Jul. 1972 24 p refs
(Contract DAHC15-67-C-0011)
(AD-757790; P-893; IDA/HQ-72-14450) Avail: NTIS CSCL 20/9

When a pellet is heated by a CO_2 laser, the tenuous plasma corona in which the light is absorbed quickly becomes collisionless. This poses a problem for CTR schemes which rely on the heated corona to compress the inner solid core of the pellet. As a replacement for collisional coupling between corona and core, the present report considers a turbulent coupling which develops from a two-stream instability between the heated corona electrons and the cold core electrons. Preliminary results indicate that the coupling is only marginally effective, unless the laser light is amplitude modulated so the heating occurs in short bursts. Author (GRA)

N73-24741# General Electric Co., Philadelphia, Pa. Space Div.
HIGH ENTHALPY EXTRACTION EXPERIMENTS IN A LARGE NON-EQUILIBRIUM MHD GENERATOR
Bert Zauderer and Eric Tate Mar. 1973 12 p refs
(Contract N00014-73-C-0039; ONR Proj. 9800)
(AD-757771; Doc-73SD214; ONR-TR-19) Avail: NTIS CSCL 10/2

The paper reports on some experiments in a shock tunnel driven-MHD generator which was designed to achieve enthalpy extractions of up to 20%. The MHD channel design changes consisted in doubling the area ratio to 6, increasing the length to 1.5m increasing the peak magnetic field strength to 4 Tesla. To date, up to 1200 kW, representing 12.6% enthalpy extraction, has been obtained in cesium seeded neon at 3470K and 2.2 Tesla. The power output was uniformly distributed along the entire channel length. Analyses of the gas dynamic data showed that, unlike the previous generators, the present generator has not reached choking conditions at the maximum enthalpy extraction. Thus, extension of the present experiments to higher magnetic fields should yield considerably higher enthalpy extractions. Author (GRA)

N73-24742# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHYSICS AND TECHNOLOGY OF PLASMA ION SOURCES
M. D. Gabovich 15 Feb. 1973 96 p refs Transl. into ENGLISH of the book "Fizika i lekhnika plazmennykh Istochnikov Ionov" 1972 p 1-304
(AD-758040; FTD-HT-23-1690-72) Avail: NTIS CSCL 20/9

Contents: Brief information on certain elemental processes occurring in plasma ion sources; Plasma ion sources (basic physical processes, designs, properties, and parameters); The mass spectrum and charge composition of beams extracted from plasma ion sources; Plasma sources of ions of refractory metals; Extraction of ions and the primary formation of ion beams. Beam propagation and a study of beams; Penetration of a plasma from an ion source into a vacuum. Energy of the ions leaving the source plasma; The vibrational properties of a plasma and their influence on the processes in plasma ion sources and neutralized ion beams. GRA

N73-24743# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
NUMERICAL SOLUTION OF THE DISPERSION RELATIONS FOR A HOT MAGNETOPLASMA WITH COLLISIONS
Robert J. Papa 6 Dec. 1972 38 p refs
(AF Proj. 5635)
(AD-757865; AFCRL-72-0712; AFCRL-PSRP-517) Avail: NTIS CSCL 20/14

Detailed numerical studies have been made on the dispersion relations for electromagnetic waves propagating in partially ionized gases immersed in a dc magnetic field. Accurate values of the attenuation constant and phase shift are needed in the design of radio communications systems where waves must propagate through an ionized gas (such as in reentry communications systems), in the design of radar jamming devices used during missile reentry, and in the analytical study of ionospheric propagation phenomena. The numerical solution of the dispersion relations enable the effects of collisionless wave damping, velocity-dependent electron-neutral collisions, and Coulomb encounters to be studied. The attenuation and phase shift of waves propagating through a plasma are dependent upon the signal frequency, plasma temperature, plasma density, degree of ionization, and cross sections for electron scattering. Graphs are presented which enable attenuation constants and phase shifts to be readily evaluated for a very wide range of possible plasma conditions. Author (GRA)

N73-24744# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE KINETIC THEORY OF THE COMPLETELY IONIZED PLASMA
Gerhard Diener 19 Mar. 1973 33 p refs Transl. into ENGLISH from Beitr. aus der Plasmaphyxik (East Ger.), v. 9, no. 5, 1969 p 405-424
(AF Proj. 4150)
(AD-758612; FTD-HC-23-1319-72) Avail: NTIS CSCL 20/9

The Bogolyubov trial solution for solving the BBGKY hierarchy is generalized for a plasma such that it includes the description of plasma operations. This means that it can be used for unstable as well as for weakly stable and weakly inhomogeneous plasmas. All quantities which describe the state of the plasma are assumed to be functionals of the (space averaged) one-particle distribution and the amplitudes of the plasma operations. The oscillations having a definite phase (coherent) and those having a statistically distributed phase (incoherent) are considered separately. The method is first illustrated with the Vlasov equation and is then transferred to the BBGKY hierarchy. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N73-24745 National Lending Library for Science and Technology, Boston Spa (England).
STRUCTURE AND AFFINITY OF ELECTROLUMINESCENT FILM
A. C. Mikolaichuk, B. S. Yugas, and V. M. Moroz 8 Feb. 1973 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (USSR), no. 9, 1971 p 16-19
(NLL-PO-2921-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The crystal structure of ZnSe films was studied by X-ray methods. It was found that the films crystallize in a cubic lattice, and the introduction of an activator into the film produces no apparent change in the crystal lattice constant. The electroluminescent brightness of excitation of ZnSe-Mn,Cu films by sinusoidal voltage, strength of voltage, and constant voltage are compared. F.O.S.

N73-24746 National Lending Library for Science and Technology, Boston Spa (England).
PHOTOELECTRONIC EMISSION FROM GaAs
P. G. Borzyak, Yu. G. Zavyalov et al 12 Mar. 1973 9 p refs Transl. into ENGLISH from Ukr. J. Phy. (USSR), v. 14, no. 3, 1969 p 402-406
(NLL-DRIC-Trans-2293-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Photoelectric emission from GaAs at different degrees of activation by absorbed layers of Cs and BaO is investigated. Differences between their characteristics of spectral response are connected with the fact that adsorbed BaO on atomic clean (110) surfaces of GaAs influences the energy of electron affinity, whereas absorbed Cs leads also to a substantial change of band bending. The peculiarities of the spectral characteristics are explained on the basis of the energetic band scheme of GaAs crystals. Author

N73-24747 Stanford Univ., Calif.
THERMOELECTRIC AND PHOTOTHERMOELECTRIC

EFFECTS IN SEMICONDUCTORS Ph.D. Thesis
Harry Bosco Kwock 1972 120 p
Avail: Univ. Microfilms Order No. 72-30653

The quantitative reliability of theoretical expressions for Hall and thermoelectric effect is tested in nondegenerate and degenerate semiconductors like CdS under thermal equilibrium conditions. Also, the reliability of these same expressions is tested when applied appropriately to nonequilibrium phenomena in high-resistivity photoconductors like CdS, and finally. A contribution is made to an assessment of the utility of the photothermoelectric effect as an analytic method for investigating transport properties of materials. Accordingly, measurements of Hall and thermoelectric effect were made on three high-conductivity crystals of CdS as a function of temperature under thermal equilibrium conditions, and measurements of photo-Hall and photothermoelectric effect were made on several low-conductivity photosensitive crystals of CdS under photoexcitation by white or monochromatic light over five orders of magnitude of conductivity, and as a function of temperature. Dissert. Abstr.

N73-24748 Wayne State Univ., Detroit, Mich.
INDUCED VOLTAGE IN CURRENT-CARRYING SUPERCONDUCTING THIN FILMS IN SUPERIMPOSED ac AND dc MAGNETIC FIELDS: A STUDY IN THE RADIO FREQUENCY AND MICROWAVE FREQUENCY RANGES Ph.D. Thesis
Edward Jay Friedman 1972 122 p
Avail: Univ. Microfilms Order No. 72-28432

A study was made of a modulation effect of the power absorption in superconducting thin films of lead and tin. The modulation was provided by an ac magnetic field and a measurement was made of both the amplitude and the phase of the modulation waveform. It was found that the phase of the modulation changed by approximately 180 deg, depending on the magnetic history of the sample. A model describing this phase-reversing aspect of the results is suggested for the case where the films were carrying currents of a microwave frequency. This model is based on the concepts of induced surface currents and the voltages generated by the motion of flux in superconductors. Under the appropriate conditions the model predicted the existence of the phase shift. A discussion is also provided concerning the general features of the radio frequency data and its relation to the microwave results. Dissert. Abstr.

N73-24749 Stanford Univ., Calif.
TEMPERATURE DEPENDENCE OF THE MERCURY TELLURIDE BAND GAP Ph.D. Thesis
Charles Stern-Paul Guenzer 1972 199 p
Avail: Univ. Microfilms Order No. 72-30637

Two theories exist to explain band gap temperature dependence, the Fan theory and the Brooks-Yu theory. The Brooks-Yu theory reduces zero temperature pseudopotentials by Debye-Waller factors describing the thermal vibrations of the ions. The two Debye-Waller factors were obtained by measuring the intensities of high order X-ray diffraction peaks from a single crystal as a function of temperature. The temperature dependences were then fitted to a Debye phonon spectrum to obtain the separate Debye temperatures. The temperature dependent bands were then computed. The Brooks-Yu theory gave the semimetal negative band gap a temperature dependence of the wrong sign and half the magnitude of the experimental value. In explaining this negative result, reasons are given why the published pseudopotential band structure calculation for mercury telluride is insufficiently precise to use as a basis for an electron-phonon interaction calculation. It was concluded that terms corresponding to the Fan theory must be included. Dissert. Abstr.

N73-24750 Rensselaer Polytechnic Inst., Troy, N.Y.
CHANNELING IN VERY THIN CRYSTALS Ph.D. Thesis
Jene Andrew Golovchenko 1972 129 p
Avail: Univ. Microfilms Order No. 72-30211

Both axial and planar channeling effects are shown to be represented by the continuum model when multiple scattering effects are small. The angular distribution of protons transmitted through silicon, germanium, and gold thin single crystals indicates that strong anisotropic directional effects can exist for the transverse motion of axially channeled particles. The implication of this result for statistical predictions about transverse motion are discussed, and the direction of future experiments for evaluating the axial continuum potential and multiple scattering effects are suggested. Dissert. Abstr.

N73-24751 Polytechnic Inst. of Brooklyn, N.Y.
STUDY OF ELECTRON CORRELATION AND BAND STRUCTURE IN SOLIDS USING THE X-RAY COMPTON EFFECT Ph.D. Thesis
Gabrielle Gibbs Cohen 1972 104 p
Avail: Univ. Microfilms Order No. 72-28220

The close relationship between X-ray inelastic scattering and the properties of the electrons inside a solid permit a direct experimental determination of such quantities as electronic density of states, band structure, electron-electron Coulomb interation, and the behavior of the electrons near the Fermi surface. Using the high resolution double crystal spectrometer, the spectra of inelastic scattering of lithium and lithium hydride for momentum transfers k = 1.76, 2.12, 2.76, 4.67, 5.45, and 6.87 1/A were taken. These spectra were corrected for instrumental broadening, for the doublet nature of the incident radiation, background, uneven illumination of the scattering sample, and multiple scattering. They were then compared with existing theories. Dissert. Abstr.

N73-24752*# National Academy of Sciences - National Research Council, Washington, D.C.
THE 9TH GENERAL ASSEMBLY AND CONGRESS OF THE INTERNATIONAL UNION FOR CRYSTALLOGRAPHY Final Report
[1972] 106 p refs Congr. held at Kyoto, Japan, 26 Aug. - 7 Sep. 1972
(Contract NASw-2391)
(NASA-CR-132048) Avail: NTIS HC $7.50 CSCL 20B

Data presented at the International Congress of Crystallography are summarized. Data cover structures, diffraction, optics, and microscopy. Solid state reactions and liquid structure were also discussed. E.H.W.

N73-24753# Bureau of Mines, College Park, Md.
PROPERTIES OF NATURAL ZEOLITES
Ronald A. Munson 1973 16 p refs
(BM-RI-7744) Avail: NTIS HC $3.00

Samples of the naturally occurring zeolites phillipsite, clinoptilolite, erionite, and chabazite were surveyed for their gas adsorption, ion exchange, and other characteristics. Chabazite and erionite, which are generally more stable, also have higher methane adsorption capacities than do the other natural zeolites. Both natural erionite and natural chabazite are classified as small-port zeolites on the basis of their inability to adsorb chlorotrifluoromethane. In the range of 8 to 100 mesh, the adsorptive capacity of natural zeolites is improved only slightly by a decrease in particle size. The capacity of natural clinoptilolite to adsorb methane is increased by cation replacement by the hydrogen ion and decreased by exchange with calcium ion. Natural phillipsite, which is easily decomposed by heat, adsorbed methane to a limited extent. Author

N73-24754*# Old Dominion Univ., Norfolk, Va. School of Engineering.
NEUTRAL BEAM DOSE AND SPUTTERING CHARACTERISTICS IN AN ION IMPLANTATION SYSTEM
A. S. Roberts, Jr., R. L. Ash, and M. H. Berger Feb. 1973 25 p refs
(Contract NAS1-9434)
(NASA-CR-132254; TR-73-T1) Avail: NTIS HC $3.25 CSCL 20L

A technique and instrument design for calorimetric detection of the neutral atom content of a 60 keV argon ion beam. A beam sampling method is used to measure local heat flux to a small platinum wire at steady state; integration of power density profiles leads to a determination of equivalent neutral beam current. The fast neutral production occurs as a result of charge transfer processes in the region of the beam system between analyzing magnet and beam stop where the pressure remains less than .00001 torr. A description of the neutral beam detector is given in section along with a presentation of results. An elementary analysis of sputter material transport from target to substrate was performed; the analysis relates to semiconductor sputtering. Author

N73-24755# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
MULTIPLE SCATTERING THEORY AND PSEUDOGAPS IN AMORPHOUS COVALENT SEMICONDUCTORS
W. John 1972 24 p refs Submitted for publication
(JINR-E4-6747) Avail: AEC Depository Libraries

A method is presented for the band structure calculation of the electronic states in crystals, which takes into account the topological connectivity of the system but considers only the nearest neighbor scattering processes. Based on the Weaire model, numerical calculations for amorphous C and Si are used to show the existence of a pseudogap, which is determined by short range order. F.O.S.

N73-24756# Brookhaven National Lab., Upton, N.Y. Div. of Metallurgy and Materials Science.
EFFECTS OF HEAT TREATMENTS ON THE SUPERCONDUCTING CRITICAL CURRENT DENSITIES OF MULTIFILAMENTARY Nb3Sn WIRES
M. Suenaga, W. B. Sampson, and T. S. Luhman 1972 21 p refs Sponsored by AEC
(BNL-17425; Conf-721111-18) Avail: NTIS

Composite conductors consisting of 19-Nb3Sn filaments in a normal metal matrix were made by heat treating wire samples consisting of 19-Nb or Nb-1% Zr filaments imbedded in a Cu-10 wt % Sn matrix. The overall size of the composite was .025 cm and each filament was approximately .0025 cm. The critical current density, Jc, at 4.2 K and 40 kG was measured for various heat treatments. It was found that the current density was a strong function of the thickness of the Nb3Sn layers formed during heat treatments. This dependence of Jc on the thickness, d, can be approximately represented. The magnetic field dependence of Jc was also measured for fields up to 150 kG. Author (NSA)

N73-24757# Florida Univ., Gainesville.
DEVELOPMENT AND APPLICATIONS OF THIN FILM DETECTORS Progress Report, 1 Jan. - 31 Dec. 1972
M. L. Muga 1972 53 p refs
(Contract AT(40-1)-2843)
(ORO-2843-22) Avail: NTIS

Topics include: the response of thin scintillation film detectors to light and heavy ions; double valued dependence of specific luminescence on ion stopping power; thin film detector response to accelerated heavy ions; response of thin film detector to selected fission fragment mass groups; emission at acute angles of light charged particles in fission decay of Cf-252; and response of TFD to fission fragments from proton-induced fission of Th-232. NSA

N73-24758# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.
NONLINEAR EXTERNAL FIELD EFFECTS QUASI-SUPERCONDUCTING FILMS
G. Parisi 2 Oct. 1972 3 p refs
(LNF-72/76) Avail: AEC Depository Libraries

Using an improved Hartree-Fock approximation on the Landau-Ginzburg equation the extra conductivity for quasi-superconducting thin films near the phase transition in the nonlinear region is computed. Author (NSA)

N73-24759# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.
EXPERIMENTAL CHECK OF NONLINEAR EFFECTS IN Al THIN FILMS CLOSE TO T
G. Lucano, S. Pace, G. Parisi, and G. L. Romani 2 Oct. 1972 4 p refs
(LNF-72/77) Avail: AEC Depository Libraries

Using a mean field approximation of the time dependent Ginzburg-Landau equation, a set of implicit equations which relate the electric field and the current in a thin film superconductor near T sub c is derived. Experimental verification for this theoretically predicted nonlinear electric field dependence of the extraconductivity in Al thin films very close to T sub c is presented. NSA

N73-24760# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
MEASUREMENT OF THE MAGNETIZATION OF A SUPERCONDUCTING COIL
E. Porrot, G. Rey, and B. Taquet Sep. 1972 49 p refs In FRENCH; ENGLISH summary Sponsored by EURATOM
(EUR-CEA-FC-661) Avail: AEC Depository Libraries

An apparatus for measuring the magnetization curve of a superconducting winding is described. The parameters of the experiment are the packing factor, the nature of the superconducting wire, and the intensity of the current in the sample. The effect of the magnetization on the value of B obtained with a superconducting coil is deduced using a computer program. NSA

N73-24761# Istituto Nazionale di Fisica Nucleare, Rome (Italy).
HIGH-RESOLUTION REFLECTION SPECTRA OF ALKALI HALIDES IN THE FAR UNTRAVIOLET
M. Antinori, A. Balzarotti, and M. Piacentini 22 Sep. 1972 36 p refs
(NP-19616; Note-402) Avail: AEC Depository Libraries

The reflectivity spectra of KCl and KBr were measured at room temperature in the photon energy range 13.5 - 20.5 eV using a helium discharge source. Care was taken of high instrumental resolution, so that several new structures were revealed, which previously were recorded only at low temperatures. The current interpretation which ascribes them to interband transitions from the valence band to high conduction states was found to be not completely satisfactory. The possibility of double excitations - a conduction electron plus a surface plasmon - was analyzed. Author

N73-24762# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
APPLICATION OF VAPOR PHASE DEPOSITS, USING SEPARATED FLUX COMPONENTS, TO THE DEVELOPMENT OF FERRIMAGNETIC MATERIALS [ETUDE D'APPLICATION DES DEPOTS EN PHASE VAPEUR, AVEC APPORT DE COMPOSANTS EN FLUX SEPARES, A LA REALISATION DE MATERIAUX FERRIMAGNETIQUES]
Moulin and Merenda 15 Dec. 1971 6 p In FRENCH
(Contract DGRST-70-7-2570)
Avail: NTIS HC $3.00

A vapor epitaxial technique for deposition of ferrimagnetic garnet thin films using separated flux components is presented, and applied to the synthesis of yttrium-iron garnets from separated yttrium oxides and iron oxide fluxes. The experimental equipment is described. ESRO

N73-24763# Pennsylvania State Univ., University Park. Materials Research Lab.
THE ON STATE IN CHALCOGENIDE THRESHOLD SWITCHES
S. H. Lee 21 Aug. 1972 4 p refs Repr. from Appl. Phys. Lett., v. 21, no. 11, 1 Dec. 1972 p 544-546
(Contract DAHC04-70-C-0047)
(AD-756273; AROD-9030-16-P) Avail: NTIS CSCL 20/12

The on-state of the chalcogenide glass threshold switch is analyzed on experimental results which call for thin free-carrier space-charge regions at the electrodes. Carriers are assumed to tunnel through the corresponding barriers which are, in turn, maintained by the joint action of the electron and hole flow. The calculated voltage-current relationship is in excellent agreement with observations. Author (GRA)

N73-24764# Purdue Univ., Lafayette, Ind.
MATERIALS SCIENCES RESEARCH Progress Report, 1 Oct. 1971 - 30 Sep. 1972
1 Dec. 1972 231 p refs
(Contract DAHC15-69-C-0213; Grant NSF GH-33574)
(AD-758374; PR-11) Avail: NTIS CSCL 20/12

Descriptions are given of the individual research programs. The descriptions also contain a listing of all personnel involved in the research, of resulting publications, and of associated meeting speeches. A combined publications list as well as a listing of M. S. and Ph. D. theses resulting from the research is provided. GRA

N73-24765# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

PHOTOEMISSION FROM AMORPHOUS SILICON Final Report
Traugott E. Fisher and Mehmet Erbudak Feb. 1973 12 p
(Grant AF-AFOSR-1742-69; AF Proj. 9763; AF Proj. 9761)
(AD-758267; AFOSR-73-0479TR) Avail: NTIS CSCL 20/12

Amorphous films were prepared by vapor quenching in ultra-high vacuum; n- and p-type silicon crystals were used as substrates and vapor source. The measurements (performed on clean and cesium covered surfaces) included photoelectric yield, energy distributions of photoelectrons, surface photovoltage, secondary emission with emphasis on elastic reflections, plasmon excitations, and Auger spectra. Information about densities of states, optical transitions, and position of Fermi level was obtained by direct comparison of photoelectric emission from the amorphous film, a silicon crystal, and a metal measured simultaneously. The results were found to depend on the mode of preparation and annealing of disordered films. (Author Modified Abstract) GRA

N73-24766# Army Foreign Science and Technology Center, Charlottesville, Va.
DENSITY OF STATES OF A(3)B(5) SEMICONDUCTOR COMPOUNDS
A. P. Dzhotyan 17 Jan. 1973 5 p refs Transl. into ENGLISH from Izv. Akad. Nauk Arm. SSR, Fiz. (Erevan), v. 6, no. 1, 1971 p 12-15
(AD-758168; FSTC-HT-23-338-73) Avail: NTIS

The density of electronic states of semiconductor compounds with a complicated of dispersion is theoretically studied, taking into account the interaction between charge carriers and impurities. The general formula is analyzed for two particular values of energy: near the Fermi level, and the bottom of conduction band. The results obtained are applicable to semiconductor compounds of the type A(III)B(V), for example, to indium antimonide, InSb. Author (GRA)

N73-24767# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SEMICONDUCTORS: COLLECTION OF ABSTRACTS
Yu. I. Koptev, comp. 12 Mar. 1973 46 p Transl. into ENGLISH of the publ. "Poluprovodniki" Leningrad, Nauka, 1968 p 1-23
(AD-758053; FTD-MT-24-1798-72) Avail: NTIS CSCL 20/12

The document contains a collection of abstracts concerning semiconductors and their properties. GRA

N73-24768# Massachusetts Univ., Boston.
EPR IN SOLIDS Final Report, 1 Apr. 1971 - 31 Mar. 1972
John R. Shane Sep. 1972 46 p refs
(Contract F19628-71-C-0161; AF Proj. 5621)
(AD-757884; AFCRL-72-0628) Avail: NTIS CSCL 20/12

A description of the EPR spectrum of Cr(3+) in Li2Ge7O15 is presented. At room temperature there are four equally populated sites which differ only in the orientation of their principal axes with respect to the orthorhombic unit cell. The locations of the principal axes and the spin-Hamiltonian parameters have been determined. At low temperatures there are two sets of four equivalent sites which are no longer related by operators of the group D(2h). Evidence of a crystallographic phase transition near 0C has been determined from the temperature dependence of the resonance. Conclusions regarding the Cr(3+) site occupancy are presented. A procedure for determining analytically the orientations of principal axes of equivalent sites has been developed. The formulation and application of this method are described. The dominant spectrum observed in unswept quartz crystals has been identified. Author (GRA)

N73-24769# City Univ. of New York. Dept. of Physics.
RAMAN SCATTERING BY POLARITONS IN ANISOTROPIC CRYSTALS
M. Lax and D. F. Nelson (Bell Labs., Murray Hill, N. J.) Feb. 1973 48 p refs
(Contract N00014-72-A-0406-0003; NR Proj. 016-124)
(AD-757810; TR-3) Avail: NTIS CSCL 20/12

The analysis of Raman scattering by polaritons in anisotropic crystals is carried out with due respect for (1) noncollinearity of propagation and Poynting vectors, (2) the influence of anisotropy on the Green's function describing the dependence of radiation efficiency on angle, (3) solid angle expansion at boundaries, including its dependence on the incidence angle, and (4) the influence of exit optics on the length of laser beam which contributes to the scattered intensity. A generalized brightness theorem valid in anisotropic media is proven. The Raman scattering efficiency is evaluated by careful use of the function-dissipation theorem. Author (GRA)

N73-24770# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
MICROWAVE SURFACE RESISTANCE OF TYPE 2 SUPERCONDUCTORS IN THE VORTEX STATE Report for Dec. 1970 - Jan. 1972
Robert J. Pedersen, Young B. Kim (Univ. of Southern Calif.), and Richard S. Thompson (Univ. of Southern Calif.) 19 Mar. 1973 42 p refs
(Contract F04701-72-C-0073)
(AD-757875; TR-0073(9230-20)-6; SAMSO-TR-73-108) Avail: NTIS CSCL 20/12

The authors have measured the microwave surface resistance of various Nb-Ta and Pb-In superconducting alloys using a derivative technique to determine its rate of change with field near H(C2). Previous dc measurements of this slope have generally been interpreted to show agreement with the Caroli-Maki theory, which Thompson has found to be incomplete. The measurements show a region of constant slope somewhat below H(C2) with a magnitude in agreement with the dc results but also show that the slope increases rapidly to approach the Thompson values in the limit H approaches H(C2). Theoretical arguments are presented indicating why the two theories can have different regions of validity. Author (GRA)

N73-24771# Battelle Columbus Labs., Ohio.
ELECTRIC FIELD INDUCED INSTABILITY IN TRANSITION METAL COMPOUNDS Final Report
Paul J. Freud Apr. 1973 33 p refs
(Grant AF-AFOSR-1930-70; AF Proj. 9763)
(AD-758270; AFOSR-73-0528TR) Avail: NTIS CSCL 20/12

Techniques were established for the preparation of high density, and homogeneous polycrystalline samples of Ni-Mn spinel and Co-Fe spinel. Contact preparation and evaluation were performed for samples of these two compounds. Non-blocking and low capacitance metallic contacts have been deposited by D. C. sputtering in a clean ultra-high vacuum system. The high electric field dependence of the conductivity of the spinel compounds Ni(0.65)Mn(2.35)O(4) and Co(1.05)Fe(1.95)O(4) were measured. Thermal changes in the conductivity due to joule self-heating were measured and calculated and the thermal changes were used to correct total high field changes to give the true electric field dependent conductivity. The measured linear electric field dependence of the conductivity is found to be in disagreement with a simple diffusion theory of hopping. Author (GRA)

N73-24772# Army Electronics Command, Fort Monmouth, N.J.
MEASUREMENTS OF EXCESS CARRIERS IN INTRINSIC GERMANIUM
M. A. Benanti, K. H. Fischer, and H. Jacobs Mar. 1973 24 p refs
(DA Proj. 1S6-62705-A-056)
(AD-758211; ECOM-4090) Avail: NTIS CSCL 20/12

Experiments were carried out in which absorption of 10 micrometer radiation has been used to investigate excess carrier densities injected into the intrinsic region of PIN diodes with large geometry. It was found that absorption of the infrared beam decreased linearly as a function of distance into the I-region, leveled off, and then increased linearly with distance as the other junction was approached when the diode was biased in the forward direction. The linear absorption behavior is explained by equations relating absorption to density and density as a function of distance. This is supported by a semiquantitative analysis. The use of a PIN diode as a 10.6 micrometer beam modulator is suggested with consideration of limiting factors, such as the length of the intrinsic region, percentage of modulation, and the role of carrier lifetime in the design of such devices. Author (GRA)

N73-24773# Harry Diamond Labs., Washington, D.C.
CONDUCTIVITY PROFILE OF CdS AFTER SULFUR DIFFU-

SION
Walter A. Riessler Feb. 1973 20 p refs
(DA Proj. 1W2-62301-A-300)
(AD-758450; HDL-TM-73-1) Avail: NTIS CSCL 20/12

A novel technique has been employed to determine the conductivity profile in the diffusion layer of cadmium sulfide acousto-electric transducers. The method requires measurement of the series resistance of the layer over a wide frequency range. When the method was applied to the CdS transducer, the conductivity was found to be proportional to the inverse third power of the distance from the end of the diffused layer. From the conductivity profile, the series capacitance as a function of frequency was computed, and results were found to agree well with measurements, confirming the validity of the method. Although this method was only applied to the CdS transducer, it should also be useful in determining the conductivity profile in similar junctions and in other materials. Author (GRA)

N73-24774# Kentucky Univ., Lexington. Dept. of Metallurgical Engineering and Materials Science.
THERMALLY ACTIVATED DEFORMATION OF CRYSTALLINE SOLIDS
B. DeMeester, C. Yin, M. Doner, and H. Conrad Nov. 1972 58 p refs Submitted for publication
(PB-214537/3; UKY-62-72-MET-17) Avail: NTIS HC $3.00 CSCL 20L

The concept of the thermally activated deformation of crystalline solids is critically reviewed. Special attention is directed towards defining thoroughly and rigorously the thermodynamic parameters associated with the activation event and their physical significance. Detailed consideration is given to the derivation of these thermodynamic parameters from experimental measurements. Author (GRA)

N73-24775# Research Inst. of National Defence, Stockholm (Sweden).
SUPERCONDUCTING QUANTUM INTERFERENCE DEVICES. 2: A MODEL FOR THE OPERATION OF A PARTLY RESISTIVE SUPERCONDUCTING POINT CONTACT QUANTUM INTERFERENCE DEVICE
J. Gavin Park (Imperial Coll., London) and Bruno Slettenmark 1972 15 p refs
(PB-214758/5; FOA-2-B 2035-E1; ISBN-91-7056-016-I) Avail: NTIS HC $3.00 CSCL 20J

A model for the operation of a partly resistive, superconducting point contact quantum interference device is presented. A general response function is calculated, and approximate expressions for the frequency dependence and noise properties at high and low frequencies are given. A novel, partly resistive double-hole device is described, and the obtained experimental results are compared with the predictions of the model. The experimental observations agree quite well with the given model in all respects, allowing for one possible exception, where the observed noise signal appears to be about one order of magnitude smaller than expected. Author (GRA)

N73-24776# Rensselaer Polytechnic Inst., Troy, N.Y. Mechanics Div.
ELASTIC AND PIEZOELECTRIC SURFACE WAVES GUIDED BY THIN FILMS
B. K. Sinha and Tiersten Mar. 1973 90 p refs
(Contract N00014-67-A-0117-0007; NR Proj. 017-504)
(AD-758688; TR-8) Avail: NTIS CSCL 09/1

A system of approximate two-dimensional surface wave equations and edge conditions in one scalar variable is derived from Hamilton's principle for linear piezoelectric media by assuming suitable depth behavior and integrating with respect to depth. The assumed behavior with depth is determined from the known straight-crested surface wave solutions of the three-dimensional equations for the plated and unplated substrate in connection with the known variable-crested solutions for the isotropic substrate. The influence of the inertia, stiffness and electrical shorting of the film is included in the analysis. (Author Modified Abstract) GRA

N73-24273* Virginia Univ., Charlottesville. Dept. of Aerospace Engineering and Engineering Physics.
THE USE OF SUPERCONDUCTIVITY IN MAGNETIC BALANCE DESIGN
F. E. Moss *In its* Develop. of a Superconducting Electromagnetic Suspension and Balance System for Dyn. Stability Studies Feb. 1973 15 p refs (For availability see N73-24271 15-11) CSCL 14B

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N73-24777*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE USE OF HYDROGEN FOR AIRCRAFT PROPULSION IN VIEW OF THE FUEL CRISIS
Solomon Weiss 1973 38 p refs Presented at NASA Res. and Technol. Advisory Comm. on Aeronaut. Operating Systems, Moffett Field, Calif., 7-8 Mar. 1973
(NASA-TM-X-68242; E-7490) Avail: NTIS HC $4.00 CSCL 21D

Some factors influencing the technical feasibility of operating a liquid hydrogen-fueled airplane are discussed in light of the projected decrease of fossil fuels. Other sources of energy, such as wind, tidal, solar, and geothermal, are briefly mentioned. In view of projected decreases in available petroleum fuels, interest has been generated in exploiting the potential of liquid hydrogen (LH2) as an aircraft fuel. Cost studies of LH2 production show it to be more expensive than presently used fuels. Regardless of cost considerations, LH2 is viewed as an attractive aircraft fuel because of the potential performance benefits it offers. Accompanying these benefits, however, are many new problems associated with aircraft design and operations; for example, problems related to fuel system design and the handling of LH2 during ground servicing. Some of the factors influencing LH2 fuel tank design, pumping, heat exchange, and flow regulation are discussed. Author

N73-24778# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.
THEORETICAL PERFORMANCE OF SIMPLE AND COMPLEX LITHIUM COMPOUNDS IN HYBRID ENGINES. PART 1: SIMPLE LITHIUM COMPOUNDS [THEORETISCHE LEISTUNGEN EINFACHER UND KOMPLEXER LITHIUMVERBINDUNGEN IN LITHERGOLEN SYSTEMEN. TEIL 1: EINFACHE LITHI UMVERBINDUNGEN]
Helmut Weiler 15 Dec. 1972 66 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-23) Avail: NTIS HC $5.50; DFVLR Porz-Wahn: 21 DM

Theoretical values of specific impulse and other performance parameters at equal conditions were calculated and plotted for interesting solid lithium fuels in combination with various oxidizers at a chamber pressure of 9.81 bar for various expansion ratios. The fuels considered were lithium, lithiumhydride, lithiumamide and lithiumnitride, while the oxidizers were fluoride. The influence of propellant density is presented. Approximate functions are described for calculating the specific impulse for various expansion ratios. Author (ESRO)

N73-24779# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
ANOMALOUS RHEOLOGICAL CHARACTERISTICS OF A HIGH INTERNAL PHASE RATIO EMULSION Final Report, Jan. 1969 - Mar. 1973
Richard J. Mannheimer Mar. 1973 23 p refs
(Contract DAAD05-67-C-0354)
(AD-758908; AFLRL-18) Avail: NTIS CSCL 21/4

High-internal-phase-ratio emulsions containing 97 to 98 percent liquid fuel as the dispersed phase, are shown to exhibit complex rheological behavior including reversible work hardening and apparent slip-flow anomalies. However, when proper precautions are taken to prevent contamination by demulsified fuel, steady flow in glass and steel tubes is characterized by

the Bingham model up to a critical wall shear stress. At higher stresses a discontinuity in the flow curve is observed. Experiments in different diameter tubes are used to establish that the critical stress is associated with the rupture of emulsion droplets and the formation of a thin film of fuel at the wall of the tube. The apparent absence of a yield value and critical stress with PTFE (Polytetrafluoroethylene) tubes indicates that the film of fuel forms when the emulsion contacts a hydrophobic surface.
Author (GRA)

N73-24780# Army Missile Command, Redstone Arsenal, Ala.
THE EFFECT OF VARIATIONS IN THERMAL PROPERTIES ON TRANSIENT THERMOVISCOELASTIC RESPONSE OF PROPELLANT GRAINS
Donald L. Martin, Jr. Jan. 1973 25 p refs
(DA Proj. 1M2-62303-A-214)
(AD-758839; RK-TR-73-2) Avail: NTIS CSCL 21/9

The sensitivity of the transient thermoviscoelastic behavior of a case-bonded propellant grain to variations in thermal properties was investigated. The results indicate that a 10-percent increase in the propellant conductivity resulted in a 4.4-percent reduction of the temperature differential across the propellant grain, a 2.4-percent reduction in the cumulative damage at the inside surface of the propellant grain, and a 22-percent increase in the cumulative damage at the case-grain interface. A 10-percent increase in the convection coefficient outside the motor case resulted in a 2.2-percent increase in the temperature differential across the propellant grain, a 2-percent increase in the cumulative damage at the inside surface of the propellant grain, and a 1-percent reduction in the cumulative damage at the case-grain interface. The variation in the thermal conductivity and convection coefficient is shown to be additive with respect to their effect on the temperature differential across the propellant grain and the cumulative damage fraction. Author (GRA)

N73-24781# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
RAMAN SCATTERING DIAGNOSTICS IN THE PRESENCE OF Al2O3
Samuel Lederman Dec. 1972 14 p
(Contract DAHC04-69-C-0077; ARPA Order 1442)
(AD-758913; PIBAL-72-39) Avail: NTIS CSCL 07/4

An experiment was conducted to determine the effect of Al2O3 on the Raman scattering from N2 and O2 in the presence of Al2O3. It was found that within the experimental accuracy, no effect could be determined. Furthermore, the presence of Al2O3 could also be ascertained using the Raman effect although no quantitative results are as yet available. Author (GRA)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N73-24782 National Lending Library for Science and Technology, Boston Spa (England).
ENERGY LOSSES IN THE TRANSIENT STATE OF AN INCIDENT FLOW ON THE MOVING BLADES OF TURBINE STAGES
A. O. Lopatitskii 8 Feb. 1973 7 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), v. 15, Aug. 1969 p 42
(NLL-CE-Trans-6113-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Experimental and theoretical investigations of the relationship between the losses in a rotating blade and a pitch irregularity after the nozzle blade are discussed. The criterion for the accuracy of determining these losses is the coincidence of the efficiency values obtained from the balance of losses in the stage, determined by two methods, namely traversing and according to momentum. Both methods revealed good coincidence in the efficiency values. The experiments show that the effect of a transient flow over moving blades is considerably higher than was hitherto assumed. Author

N73-24783* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ION THRUSTER WITH A COMBINATION KEEPER ELECTRODE AND ELECTRON BAFFLE Patent
Eugene V. Pawlik and Dennis J. Fitzgerald, inventors (to NASA) Issued 24 Apr. 1973 4 p Filed 20 Dec. 1971 Supersedes N72-20766 (10 - 11, p 1519) Sponsored by NASA
(NASA-Case-NPO-11880; US-Patent-3,728,861;
US-Patent-Appl-SN-209535; US-Patent-Class-60-202;
US-Patent-Class-313-63; US-Patent-313-204;
US-Patent-Class-313-231; US-Patent-Class-313-DIG.8) Avail: US Patent Office CSCL 21C

An ion thruster is described in which the cathode front end, surrounded by our insulator, is mounted flush with the front end of the flanged portion of the cathode pole piece. The thruster's baffle positioned in front of the cathode's front end supports the thruster's keeper electrode which is space apart and directed to the cathode's open end. The baffle is at the keeper's electrode potential. Official Gazette of the U.S. Patent Office

N73-24784* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLID PROPELLANT ROCKET MOTOR Patent
Warren L. Dowler, John I. Shafer, John W. Behm, and Leon D. Strand, inventors (to NASA) Issued 1 May 1973 7 p Filed 28 May 1971 Supersedes N71-34949 (09 - 21, p 3502)
(NASA-Case-NPO-11559; US-Patent-3,729,935;
US-Patent-Appl-SN-147996; US-Patent-Class-60-256;
US-Patent-Class-60-254; US-Patent-Class-102-49.7;
US-Patent-Class-102-49.8) Avail: US Patent Office CSCL 21H

The characteristics of a solid propellant rocket engine with a controlled rate of thrust buildup to a desired thrust level are discussed. The engine uses a regressive burning controlled flow solid propellant igniter and a progressive burning main solid propellant charge. The igniter is capable of operating in a vacuum and sustains the burning of the propellant below its normal combustion limit until the burning propellant surface and combustion chamber pressure have increased sufficiently to provide a stable chamber pressure.
Official Gazette of the U.S. Patent Office

N73-24785 Wisconsin Univ., Madison.
A COMPARISON STUDY OF THREE-DIMENSIONAL ANALYSIS TECHNIQUES AND LOSS CALCULATIONS FOR AXIAL FLOW TURBINES Ph.D. Thesis
Richard James Timm 1972 233 p
Avail: Univ. Microfilms Order No. 72-23079

The application of three-dimensional analysis to axial turbines is discussed. Two analysis techniques are presented. These two techniques are compared in an effort to assess the conditions under which each method is more appropriate. In addition, to stimulate discussion on analysis techniques, two different sources of loss data are also investigated: one being an established standard in the field and another relatively new. The application of these data sets to three-dimensional analysis techniques is explored in detail. Results of this study can be divided into two major parts: (1) comparison of two methods of calculating turbine loss parameters and (2) comparison of radial equilibrium and streamline curvature techniques. Dissert. Abstr.

N73-24786*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A SIMPLE PERFORMANCE CALCULATION METHOD FOR LH2/LOX ENGINES WITH DIFFERENT POWER CYCLES
Robert H. Schmucker (Natl. Res. Council) 16 Feb. 1973 42 p refs
(NASA-TM-X-64749) Avail: NTIS HC $4.25 CSCL 21H

A simple method for the calculation of the specific impulse of an engine with a gas generator cycle is presented. The solution is obtained by a power balance between turbine and pump. Approximate equations for the performance of the combustion products of LH2/LOX are derived. Performance results are compared with solutions of different engine types. Author

N73-24787# National Aerospace Lab., Tokyo (Japan).
STUDIES OF IDPF SERVOVALVE APPROPRIATE FOR

GIMBALED ENGINE POSITIONING HYDRAULIC CONTROL SYSTEMS
Shigeki Hatayama 1972 70 p refs In JAPANESE; ENGLISH summary
(NAL-TR-303) Avail: NTIS HC $5.50

The design is discussed of the IDPF servovalve, which is composed of a torque-motor, a nozzle-flapper, a spool-valve and an IDPF hydromechanical compensation network. A typical servovalve is analyzed, and a block diagram is presented. The design conditions for maximizing the servovalve are derived, and a numerical design is presented to illustrate the effectiveness of this procedure. The servovalve is considered to be applicable to controlling a massive antenna, or a massive table on a milling machine. Author

N73-24788# Advisory Group for Aerospace Research and Development, Paris (France).
RELATIVE AIR POLLUTION EMISSION FROM AN AIRPORT IN THE UK AND NEIGHBOURING URBAN AREAS
A. W. C. Keddie (Dept. of Trade and Ind., Stevenage, Engl.), G. H. Roberts (Dept. of Trade and Ind., Stevenage, Engl.), and J. Parker (Dept. of Trade and Ind., Stevenage, Engl.) [1971] 10 p refs Repr. from the publ. "Conference Pre-print No. 125 on Atmospheric Pullution by Aircraft Engines" Paris, AGARD, 10 p Avail: NTIS HC $3.00

Air pollution levels at Stansted Airport, England, in relation to emissions from four nearby towns are discussed. Calculations have been made of pollution emissions from these four sources and also from the airport, and the expected contributions from these sources at three local sites have been examined. These values are compared with actual measurements at the three sites. Author

N73-24789# Northern Research and Engineering Corp., Cambridge, Mass.
THE CONTROL OF OXIDES OF NITROGEN EMISSIONS FROM AIRCRAFT GAS TURBINE ENGINES. VOLUME 1: PROGRAM DESCRIPTION AND RESULTS
R. S. Fletcher, R. D. Siegel, and E. K. Bastress Dec. 1971 109 p refs
(Contract DOT-FA70WA-2428)
(Rept-1162-1-Vol-1) Avail: NTIS HC $7.50

An analysis of the aircraft engine exhaust products which contribute to the air pollution problem was conducted. Nitrogen oxides are the only pollutant class for which control criteria do not exist. Mathematical models were developed to establish criteria for application to a range of aircraft engines. It was determined that aircraft contributions to regional loads in all categories are generally less than one percent. In the vicinity of major air terminals, densities and concentrations of aircraft emissions are comparable to densities and concentrations in adjacent communities of the same pollutants from other sources. Design criteria for combustors to reduce the amount of oxide emissions are described. Author

N73-24790# Northern Research and Engineering Corp., Cambridge, Mass.
THE CONTROL OF OXIDES OF NITROGEN EMISSIONS FROM AIRCRAFT GAS TURBINE ENGINES. VOLUME 2: THE NITRIC OXIDE FORMATION PROCESS
R. S. Fletcher and R. D. Siegel Dec. 1971 143 p refs
(Contract DOT-FA70WA-2428)
(Rept-1162-2-Vol-2) Avail: NTIS HC $9.25

The chemical reactions which produce nitrogen oxides during aircraft engine operation are described. A mathematical analysis of the formation process is developed, the resulting computer program is described, and a user's manual for the program is included. The capabilities and limitations of the computer program are explained. Author

N73-24791# Northern Research and Engineering Corp., Cambridge, Mass.
THE CONTROL OF OXIDES OF NITROGEN EMISSIONS FROM AIRCRAFT GAS TURBINE ENGINES. VOLUME 3: THE FLOW MODEL
R. S. Fletcher and R. D. Siegel Dec. 1971 173 p refs
(Contract DOT-FA70WA-2428)
(Rept-1162-3-Vol-3) Avail: NTIS HC $10.75

The development of a computer program to describe the flow conditions in a gas turbine combustor is discussed. Thermodynamic data computed in the computer program for nitrogen oxide formation are used as input data to the turbine combustor program. The theory behind the flow model and details of the computer program developed for its application are presented. Author

N73-24792*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PARAMETRIC INVESTIGATION OF ENCLOSED KEEPER DISCHARGE CHARACTERISTICS
Ted W. Sheheen and Robert C. Finke Washington May 1973 11 p refs
(NASA-TM-X-2799; E-7345) Avail: NTIS HC $3.00 CSCL 10C

Volt-ampere discharge characteristics of an enclosed keeper hollow cathode discharge were measured as a function of the mercury flow rate and external circuit impedance. Discharge currents were varied from 0 to 1 ampere and voltages were 7 to 39 volts. Batteries and a vacuum tube control circuit were used to obtain characteristics curves that were independent of power supply impedance. Variation of the neutral flow results in changes in the discharge which interact with the impedance of the external circuit, and under some conditions, give rise to multiple operating points. Author

N73-24793*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A 13000-HOUR TEST OF A MERCURY HOLLOW CATHODE
Vincent K. Rawlin Washington Jun. 1973 22 p refs
(NASA-TM-X-2785; E-7163) Avail: NTIS HC $3.00 CSCL 21C

A mercury-fed hollow cathode was tested for 12,979 hours in a bell jar at SERT 2 neutralizer operating conditions. The net electron current drawn to a collector was 0.25 ampere at average collector voltages between 21.8 and 36.7 volts. The mercury flow rate was varied from 5.6 to 30.8 equivalent milliamperes to give stable operation at the desired electrode voltages and currents. Variations with time in the neutralizer discharge characteristics were observed and hypothesized to be related to changes in the cathode orifice dimensions and the availability of electron emissive material. A facility failure caused abnormal test conditions for the last 876 hours and led to the cathode heater failure which concluded the test. Author

N73-24794*# Pratt and Whitney Aircraft, East Hartford, Conn.
SINGLE STAGE EVALUATION OF HIGHLY LOADED HIGH MACH NUMBER COMPRESSOR STAGES. 6: DATA AND PERFORMANCE OF CANTILEVERED STATOR
A. S. Merrow Nov. 1972 107 p refs
(Contract NAS3-10482)
(NASA-CR-121141; PWA-4606) Avail: NTIS HC $7.50 CSCL 21H

A compressor stage with a rotor tip speed of 1600 ft/sec was tested to evaluate its performance with a cantilevered stator and a rotating inner shroud beneath the stator. Both the rotor blades and the stator vanes were composed of multiple circular arc airfoil sections. Comparison of data taken during this test of the cantilevered stator and previous tests with the same compressor and airfoil geometry in a shroud stator configuration showed only slight differences in stage performance with no significant effect on overall efficiency. However, the severity of the stator wake near the rotating hub was decreased at all flows including the near surge condition. Stall and wise open discharge corrected weight flows were the same as for the shrouded stator configuration. Author

N73-24795# Lockheed Missiles and Space Co., Palo Alto, Calif.
THRUST CUTOFF IN A SOLID FUEL ROCKET ENGINE. FORCED QUENCHING OF THE SOLID FUEL CHARGE IN THE CHAMBER
B. A. Raizberg, B. T. Erokhin, and K. P. Samsonov [1973] 33 p Transl. into ENGLISH from the book "Osnovy Teorii Rabochikh Protsessov v Raketnykh Sistemakh na Tverdom Toplive" Moscow, Mashinostr., 1972 p 222-250
Avail: NTIS HC $3.00; National Translation Center, John Crerar Library, Chicago, Ill. 60616

Fundamental regularities of processes progressing in a solid fuel engine during thrust cutoff by opening additional holes, and during quenching of solid fuel charge by spraying a liquid coolant into the combustion chamber are outlined. Methods are proposed for computing the fundamental ballistics characteristics during engine operation in the appropriate transition mode.
Author

N73-24796*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MAGNETIC FLUX DENSITY ENVIRONMENT OF SEVERAL ELECTRON-BOMBARDMENT ION THRUSTERS
Ronald L. Danilowicz May 1973 15 p refs
(NASA-TM-X-68239; E-7458) Avail: NTIS HC $3.00 CSCL 21C

Measurements of the external magnetic field of several electron-bombardment mercury ion thrusters were made using a single axis fluxgate magnetometer. The axial dipole moment accounted for most of the external field. In addition, residual fields from an electromagnet thruster were approximately 20 percent of the initial field. Simple degaussing of the axial magnets reduced the residual fields to 1 to 2 percent of the initial field.
Author

N73-24797*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PARAMETRIC TEST RESULTS OF A SWIRL-CAN COMBUSTOR
Richard W. Niedzwiecki and Robert E. Jones 1973 22 p refs Presented at the 75th Natl. Meeting, Detroit, 4-6 Jun. 1973; sponsored by Am. Inst. of Chem. Engr.
(NASA-TM-X-68247; E-7501) Avail: NTIS HC $3.25 CSCL 21A

Pollutant levels of oxides of nitrogen, unburned hydrocarbons, and carbon monoxide were measured for three models of an experimental, annular swirl can combustor. The combustor was 1.067 meters in outer diameter, incorporated 120 modules, and was specifically designed for elevated exit temperature performance. Test conditions included combustor inlet temperatures of 589, 756 and 839 K, inlet pressures of 3 to 6.4 atmospheres, reference velocities of 21 to 38 meters per second and combustor equivalence ratios, based on total combustor flows of 0.206 to 1.028. Maximum oxides of nitrogen emission index values occurred at an equivalence ratio of 0.7 with lower values measured for both higher and lower equivalence ratios. Oxides of nitrogen concentrations, to the 0.7 level with 756 K inlet air, were correlated for the three models by a combined parameter consisting of measured flow and geometric parameters. Effects of the individual parameters comprising the correlation are also presented.
Author

N73-24798*# Thiokol Chemical Corp., Brigham City, Utah. Wasatch Div.
STUDY OF SOLID ROCKET MOTOR FOR SPACE SHUTTLE BOOSTER, VOLUME 2, BOOK 2 Final Report
15 Mar. 1972 199 p
(Contract NAS8-28430)
(NASA-CR-123926; TWR-5672-Vol-2-Bk-2) Avail: NTIS HC $12.00 CSCL 21H

A technical analysis of the solid propellant rocket engines for use with the space shuttle is presented. The subjects discussed are: (1) solid rocket motor stage recovery, (2) environmental effects, (3) man rating of the solid propellant rocket engines, (4) system safety analysis, (5) ground support equipment, and (6) transportation, assembly, and checkout.
Author

N73-24799*# Thiokol Chemical Corp., Brigham City, Utah. Wasatch Div.
STUDY OF SOLID ROCKET MOTOR FOR SPACE SHUTTLE BOOSTER, VOLUME 2, BOOK 3, APPENDIX A Final Report
15 Mar. 1972 223 p
(Contract NAS8-28430)
(NASA-CR-123728; TWR-5672-Vol-2-Bk-3-App-A) Avail: NTIS HC $13.25 CSCL 21H

A systems requirements analysis for the solid propellant rocket engine to be used with the space shuttle was conducted. The systems analysis was developed to define the physical and functional requirements for the systems and subsystems. The operations analysis was performed to identify the requirements of the various launch operations, mission operations, ground operations, and logistic and flight support concepts.
Author

N73-24800*# Thiokol Chemical Corp., Brigham City, Utah. Wasatch Div.
STUDY OF SOLID ROCKET MOTOR FOR SPACE, SHUTTLE BOOSTER, VOLUME 2, BOOK 4 APPENDICES B THRU D Final Report
15 Mar. 1972 143 p
(Contract NAS8-28430)
(NASA-CR-124237; TWR-5672-Vol-2-Bk-4-App-B-D) Avail: NTIS HC $9.25 CSCL 21H

The mass properties and related data for the solid propellant rocket engine for use with the space shuttle are presented. Data for three solid propellant rocket engines are provided. The three designs considered are: (1) baseline parallel burn, (2) optional parallel burn, and (3) baseline series burn. Layouts of the respective designs to show design and dimensional data are included.
Author

N73-24801*# Thiokol Chemical Corp., Brigham City, Utah. Wasatch Div.
STUDY OF SOLID ROCKET MOTOR FOR SPACE SHUTTLE BOOSTER, VOLUME 2, BOOK 5, APPENDICES E THRU H, Final Report
15 Mar. 1972 140 p
(Contract NAS8-28430)
(NASA-CR-123730; TWR-5672-Vol-2-Bk-5-App-E-H) Avail: NTIS HC $9.00 CSCL 21H

Preliminary parametric studies were performed to establish size, weight and packaging arrangements for aerodynamic decelerator devices that could be used for recovery of the expended solid propellant rocket motors used in the launch phase of the Space Shuttle System. Computations were made using standard engineering analysis techniques. Terminal stage parachutes were sized to provide equilibrium descent velocities for water entry that are presently thought to be acceptable without developing loads that could exceed the boosters structural integrity. The performance characteristics of the aerodynamic parachute decelerator devices considered are based on analysis and prior test results for similar configurations and are assumed to be maintained at the scale requirements of the present problem.
Author

N73-24802*# Thiokol Chemical Corp., Brigham City, Utah. Wasatch Div.
STUDY OF SOLID ROCKET MOTOR FOR SPACE SHUTTLE BOOSTER. VOLUME 4: COST Final Report
15 Mar. 1972 177 p
(Contract NAS8-28430)
(NASA-CR-124239; TWR-5672-Vol-4) Avail: NTIS HC $11.00 CSCL 21H

The cost data for solid propellant rocket engines for use with the space shuttle are presented. The data are based on the selected 156 inch parallel and series burn configurations. Summary cost data are provided for the production of the 120 inch and 260 inch configurations. Graphs depicting parametric cost estimating relationships are included.
Author

N73-24803*# Analytical Mechanics Associates, Inc., Seabrook, Md.
A STUDY OF THE APPLICABILITY OF SOLAR ELECTRIC PROPULSION Final Report
F. I. Mann and Jerry L. Horsewood Dec. 1971 79 p refs
(Contract NAS5-11364)
(NASA-CR-130245; Rept-71-43) Avail: NTIS HC $6.00 CSCL 21C

A summary is given of a one-year study to determine the applicability of solar electric propulsion as a means of primary propulsion for the unmanned exploration of the solar system. Missions to a wide variety of solar system targets were investigated, including Venus, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto, Ceres, Eros, Geographos, Icarus, D'Arrest, and Encke.
Author

N73-24804# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.

EXTENSION OF STUDY 13.4: PERFORMANCE ANALYSIS OF A SOLAR ELECTRIC PROPULSION MODULE FOR EXTRA-ECLIPTIC AND COMETARY MISSIONS (EUROPA 3) Final Report
Jul. 1972 91 p
(Contract ELDO-CTR-17/4/57; MBB-Proj-6.508.1)
Avail: NTIS HC $6.75

The most important parameters for achieving one A U out of ecliptic missions with combined chemical plus solar electric propulsion are evaluated. The present status of technology with respect to the solar electric module are discussed. In general it can be stated that the out of ecliptic mission is feasible and that with a relatively small spacecraft a high inclination can be achieved. ESRO

N73-24805# Chandler Evans, Inc., West Hartford, Conn. Control Systems Div.
ADVANCED ENGINE CONTROL PROGRAM Final Report
A. H. White and D. F. Wills Nov. 1972 304 p refs
(Contract DAAJ02-70-C-0002; DA Proj. 1G1-62203-D-144) (AD-758173; R-492-31; USAAMRDL-TR-72-59) Avail: NTIS CSCL 21/5

The report summarizes the results of a 30-month program of design, fabrication, and test of an advanced electronic engine control system for small turboshaft engines. The objective of the program was to develop engine control system technology which could be implemented in future systems to alleviate many of the problems experienced with past and present control systems. The system is comprised of three modules: a fuel-cooled hybrid electronic computer, a fluid controller with integral 37,500-rpm pump, and a remote electrohydromechanical engine geometry actuator. Closed-loop tests were made to demonstrate the control system performance on both a 2- and a 5-lb/sec analog computer engine simulator. Environmental temperature endurance testing and fuel contamination testing were completed. (Author Modified Abstract) GRA

N73-24806# European Research Office, London (England).
VISIT TO THE UNIVERSITY OF STUTTGART INSTITUTE FOR AEROSPACE PROPULSION, STUTTGART, GERMANY
Richard L. Scharpf Feb. 1973 29 p
(AD-758150; ERO-1-73) Avail: NTIS CSCL 21/1

A visit to the Institute for Aerospace Propulsion, University of Stuttgart, Germany, is described. The current research efforts under one professor are discussed, and a detailed description of the air breathing engine test facility is included. Author (GRA)

N73-24807# Naval Postgraduate School, Monterey, Calif. Dept. of Mechanical Engineering.
AN ENVIRONMENTAL HEAT TRANSFER STUDY OF A ROCKET MOTOR STORAGE CONTAINER SYSTEM M.S. Thesis
Allen H. Wirzburger Dec. 1972 168 p refs
(AD-758515) Avail: NTIS CSCL 13/4

The heat transfer characteristics of a rocket motor storage container system have been investigated using analytical and experimental techniques. Analytically, both closed form and numerical solutions have been developed. These solutions may be used to determine maximum temperatures and temperature gradients within the rocket motor. It is proposed that the theoretical solutions can be used to thermally optimize container design. A secondary investigation was carried out to determine the feasibility of using cholesteric liquid crystals, a temperature sensitive material, to thermally map the surface of the container. The crystals appear to remain stable under desert type conditions and produce brilliantly colored displays of the temperature field. Author (GRA)

N73-24808# Naval Postgraduate School, Monterey, Calif.
VECTORED THRUST CONTROL M.S. Thesis
Brian John Horais Dec. 1972 100 p refs
(AD-758521) Avail: NTIS CSCL 21/8

Supersonic two-dimensional flow from a nozzle with the exit plane inclined to the central axis of the nozzle will be turned if the exit pressure of the nozzle is not matched to the external pressure. The direction and magnitude of the flow deflection angle and the resulting deflection force is a function of the exit pressure of the nozzle, the exit Mach number and the amount the exit plane is inclined to the central axis of the nozzle. A study of the deflection forces and deflection angles generated for a Mach number range of 1.2 to 2.4 and for a wide range of exit pressures is presented in the report. Author (GRA)

N73-24809# Pratt and Whitney Aircraft, East Hartford, Conn.
SUPERSONIC TORSIONAL FLUTTER IN CASCADES Final Technical Report, 16 Feb. 1972 - 16 Feb. 1973
Lynn E. Snyder 2 Apr. 1973 59 p refs
(Contract N00019-72-C-0187)
(AD-758721; PWA-4701) Avail: NTIS CSCL 21/5

A combined analytical and experimental study was made to determine the mechanism of supersonic unstalled torsional flutter in cascades of compressor blades. An unsteady supersonic cascade analysis was used to predict the onset conditions for supersonic torsional flutter. Two sets of blades, characteristic of those used in high-speed fan rotors, were tested to determine the position of the flutter boundary, and the characteristics of the aeroelastic instability. (Author Modified Abstract) GRA

N73-24016 Ministry of Aviation, London (England).
THEORY AND TUNNEL TESTS OF ROTOR BLADES FOR SUPERSONIC TURBINES
B. S. Stratford and G. E. Sansome *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 887-928 refs Previously issued as NGTE-245; ARC-22537 (For availability see N73-24011 15-01)
(ARC-R/M-3275; NGTE-R-245; ARC-22537)

N73-24048* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENGINE SELECTION FOR TRANSPORT AND COMBAT AIRCRAFT
James F. Dugan, Jr. *In* AGARD Aircraft Performance: Prediction Methods and Optimization Mar. 1973 55 p refs (For availability see N73-24042 15-02)
CSCL 21A

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N73-24810 Michigan Univ., Ann Arbor.
A CLOUD CHAMBER STUDY OF HIGH TRANSVERSE MOMENTA IN COSMIC RAY AIR SHOWERS Ph.D. Thesis
Donald Frederick Winterstein 1972 75 p
Avail: Univ. Microfilms Order No. 72-29240

The results of an experimental investigation into the possibility of using the large Leeds cloud chamber and its associated scintillator array to study multicore structure of extensive cosmic ray air showers (EAS) are presented. The detectors recorded the lateral density distribution of ionizing shower particles over an area of about 50 sq m; spatial resolution, however, was good only within the 2.88 sq m horizontal area of the cloud chamber. The shower studied ranged in size from about 20,000 to 5 million particles. The investigation was carried out by examining cloud chamber and scintillator data of 1750 EAS for the existence of subcores that represented transverse momenta considerably larger than the mean transverse momentum for pion production, at machine energies, of about 0.4 GeV/c. The conclusion was that, with sufficiently strict subcore selection criteria, the apparatus appeared usable for multicore studies. Dissert. Abstr.

N73-24811# Potchefstroom Univ. for Christian Higher Education (South Africa). CSIR Cosmic Ray Research Unit.
COSMIC RAY NEUTRON MONITOR DATA, SANAE, ANTARCTICA, 1971
Mar. 1973 50 p
(S-6) Avail: NTIS HC $4.50

Tabulated neutron monitor data are presented for 1971. F.O.S.

N73-24812# Potchefstroom Univ. for Christian Higher Education (South Africa). CSIR Cosmic Ray Research Unit.
COSMIC RAY NEUTRON MONITOR DATA, POTCHEFSTROOM, 1972
Apr. 1973 38 p
(P-2) Avail: NTIS HC $4.00

Tabulated neutron monitor data are presented for 1972. F.O.S.

N73-24813# Potchefstroom Univ. for Christian Higher Education (South Africa). Dept. of Physics.
COSMIC RAY NEUTRON MONITOR DATA, POTCHEFSTROOM, MAY - DECEMBER 1971
Jan. 1973 26 p
(P-1) Avail: NTIS HC $3.50

Tabulated neutron monitor data are presented for the period from May 1971 to December 1971. F.O.S.

N73-24814*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE OUTER LIMIT FOR THE EXPANSION OF MAGNETIC BOTTLES EJECTED BY SOLAR PROTON FLARES
Kunitomo Sakurai (Maryland Univ.) May 1973 14 p refs
(NASA-TM-X-66243; X-693-73-119) Avail: NTIS HC $3.00 CSCL 03B

Pioneer 6 observations of proton flare ejected magnetic bottles are reported. The SSC geomagnetic storms, electron density distribution near the sun, and Faraday rotation induced by the flares are included. Magnetic bottle speed is discussed. E.H.W.

N73-24815*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DIFFUSE X-RAY SPECTRUM FROM 14-200 keV AS MEASURED ON OSO-5
B. R. Dennis, A. N. Suri (NAS-NRC), and K. J. Frost May 1973 30 p refs Submitted for publication
(NASA-TM-X-66252; X-682-73-148) Avail: NTIS HC $3.50 CSCL 03B

The measurement of energy spectrum of the diffuse component of cosmic X-ray flux made on the OSO-5 spacecraft is described. The contributions to the total counting rate of the actively shielded X-ray detector are considered in some detail and the techniques used to eliminate the non-cosmic components are described. Positive values for the cosmic flux are obtained in seven energy channels between 14 and 200 keV and two upper limits are obtained between 200 and 254 keV. The results can be fitted by a power law spectrum. A critical comparison is made with the OSO-3 results. Conclusions show that the reported break in the energy spectrum at 40 keV is probably produced by an erroneous correction for the radioactivity induced in the detector on each passage through the intense charged particle fluxes in the South Atlantic anomaly. Author

N73-24816*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MEASUREMENTS OF THE PERFORMANCE OF MULTIWIRE PROPORTIONAL CHAMBERS
R. W. Austin, A. Eglitis (Ala. Univ., Huntsville), J. C. Gregory (Ala. Univ., Huntsville), S. A. Metzger, T. A. Parnell, H. F. Rutledge, W. Selig, and N. P. Cumings Washington Jun. 1973 26 p refs Prepared by Ala. Univ., Huntsville
(NASA-TN-D-7317; M-453) Avail: NTIS HC $3.00 CSCL 03B

Data are presented that may be useful in formulating engineering specifications and test procedures for the proportional counter hodoscope to be flown as part of the High Energy Cosmic Ray Experiment on the High Energy Astronomy Observatory (HEAO), Mission A. A collection of preliminary data taken in laboratory tests of multiwire counters with an anode wire spacing of 5 mm and cathode gap spacing of 1 cm is presented. The data are from laboratory development models or counters for balloon flights and were selected to illustrate several aspects of proper and improper counter performance. Most of the data were taken from a large proportional counter hodoscope which has an active area of 0.5 by 0.5 m and 104 wires per plane. Author

N73-24817# Lockheed Missiles and Space Co., Palo Alto, Calif.
THE "INTERKOSMOS" SATELLITES STUDY COSMIC RAYS
N. L. Grigoron and P. V. Vakulov [1973] 13 p refs Transl. into ENGLISH from Priroda (Moscow), no. 10, 1972 p 29-36
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

The dynamic properties, geomagnetic effects, and galactic sources of cosmic rays are discussed in light of observations made by the Intercosmos 3 and Intercosmos 5 satellites. The specific areas of observation reported consist of corpuscular radiation in the close near-earth space; the phenomenon of particle dropping; the relationship between cosmic radiation and very low frequency electromagnetic waves; and the nature of very low frequency wave propagation under conditions of diverse magnetospheric disturbances. Detailed descriptions of orbital mechanics, satellite configurations, and onboard equipment are provided. J.M.M.

N73-24818*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
COSMIC RAYS OVER THE UPPER MID-WEST Ph.D. Thesis
Thomas A. Rygg Dec. 1972 181 p refs
(Grants NGR-21-002-066; NGL-21-002-008; Contract Nonr-710(19))
(NASA-CR-132056; TR-73-081) Avail: NTIS HC $11.25 CSCL 04A

Differential energy spectra of cosmic ray protons and helium nuclei in the 100 to 260 MeV/nucleon were measured on balloon flights in the upper midwestern (U.S.) area. Solar cycle variations of atmospheric secondary protons were also investigated. Author

N73-24819# Bergen Univ. (Norway). Dept. of Physics.
SOLAR DIURNAL AND SEMIDIURNAL VARIATIONS IN THE COSMIC RAY NM-DATA 1965 - 1969 RECORDED IN BERGEN
A. M. Aksland and R. Amundsen Nov. 1972 15 p refs
(NP-19650; TR-48) Avail: AEC Depository Libraries

Methods of analysis applied to the study of the solar diurnal and semidiurnal variations in cosmic ray neutron monitor (NM) data are outlined, and the results from 1965 to 1969 for the Bergen neutron monitor are presented and related to findings obtained by other groups. The results based on the Bergen NM data yield amplitudes and phases of 0.344% and 0.045%, and about 18h and 3h respectively, for the first and second harmonics. The findings compare nicely with the functional relations found by Rao from a worldwide network of stations. The two-component diurnal variation found by Forbush from ion chamber data is not present in these NM data. The theoretical state of affairs as to the explanations of the diurnal and semidiurnal effects is stated. Author (NSA)

N73-24820# Alaska Univ., College. Geophysical Inst.
STUDIES OF THE SOLAR AND TERRESTRIAL RADIATION FLUXES OVER ARCTIC PACK ICE Final Technical Report, 1 Jun. 1971 - 31 Dec. 1972
Bjorn E. Holmgren and Gunter E. Weller Mar. 1973 30 p refs
(Contract N00014-71-A-0364-0001; ARPA Order 1783; NR Proj. 307-343)
(AD-758060; FTR-3) Avail: NTIS CSCL 04/1

The report describes some measurements carried out during 1972 AIDJEX that have not been accounted for in earlier reports under this contract. Determinations of the turbidity coefficient gave a mean value of 0-078, indicating that the dust scattering is considerable in the Arctic atmosphere. Incoming and outgoing short-wave and long-wave radiation fluxes were monitored by 4 Eppley precision pyranometers. The variations of these fluxes and of the radiation balance are discussed, especially in relation to the cloud conditions. Author (GRA)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N73-24821 Rensselaer Polytechnic Inst., Troy, N.Y.
ON-LINE PARAMETER UPDATING FOR MARS STRATOSPHERE AND TROPOSPHERE Ph.D. Thesis
James Constant Duke 1972 208 p
Avail: Univ. Microfilms Order No. 72-30208

A technique is developed for onboard computation of the uncertain Mars atmosphere parameters ahead of an entry vehicle utilizing a maximum-likelihood sequential estimation scheme. Both three and four parameter atmosphere models are developed which permit continuous tracking of the atmosphere profile at all altitudes including the adiabatic troposphere region, the isothermal portion of the stratosphere, and all other atmospheric regions in which the temperature gradient can be assumed to remain constant. The onboard estimation scheme varies depending upon whether the available external measurement information is the local atmospheric density, density plus temperature; or density, temperature, and pressure. In the case when only the density measurements are available, a particularly difficult problem arises in obtaining the starting error covariance matrix for the three uncertain troposphere parameters. Dissert. Abstr.

N73-24822 Princeton Univ., N.J.
NONSPHERICAL GRAVITATIONAL COLLAPSE AND BLACK HOLE UNIQUENESS Ph.D. Thesis
Robert Manuel Wald 1972 154 p
Avail: Univ. Microfilms Order No. 72-29837

A study was made of nonspherical gravitational collapse, particularly to the determination of the possible final state configurations resulting from complete collapse. Spherical gravitational collapse and the arguments leading to the conclusions that (1) sufficiently massive spherical bodies must undergo complete gravitational collapse and (2) the final state of this collapse is a Schwarzschild black hole. Collapse with small deviations from spherical symmetry is treated and the arguments which show that a spacetime singularity must be produced are introduced. Some aspects of highly nonspherical gravitational collapse with plane and cylindrical symmetry are discussed and arguments which indicate that fragmentation will occur during such collaspse are presented. The question of whether collapse with small deviations from spherical symmetry does indeed produce a black hole rather than a naked singularity is discussed in detail. Dissert. Abstr.

N73-24823 Princeton Univ., N.J.
SCALAR WAVES AND TENSOR PERTURBATIONS IN THE MIXMASTER UNIVERSE
Bei-Lok Hu 1972 167 p
Avail: Univ. Microfilms Order No. 72-29791

Studies on scalar waves in the Mixmaster Universe are directed towards an understanding of the interaction between matter and geometry -- how anisotropic vibration of the Universe effects particle creation and how particle creation changes the geometry of the Universe. First, wave equation in a fixed Mixmaster background is studied. Separability conditions on the Laplace-Beltrami equation is related to the complete sets of invariant operators of the symmetry group SO3. Invariance of the Mixmaster space under the 4-group characterizes the wave functions into 4 symmetry species and causes the factorization of the energy matrix into 4 submatrices. Eigenvalues and expansion coefficients for the wave functions are calculated for some low-lying levels. Studies on tensor perturbations in the Mixmaster Universe are directed towards an understanding of the nature of the general cosmological solution to the Einstein equations. Dissert. Abstr.

N73-24824 Princeton Univ., N.J.
THE GRAVITATIONAL AND ELECTROMAGNETIC INTERACTIONS OF A BLACK HOLE
Bahram Mashhoon 1972 108 p
Avail: Univ. Microfilms Order No. 72-29806

The interaction of an electromagnetic wave with a black hole and the tidal effects of a black hole on smaller objects are investigated. The problem of the propagation of electromagnetic waves in a gravitational field can be reduced to the problem of wave propagation in a material medium in flat space-time. This method is used to calculate the scattering cross section and the final polarization of a plane wave incident on a Reissner-Nordstrom black hole. It is shown that the polarization of the wave is not affected by the presence of the spherically symmetric gravitational field of the black hole. However, the final polarization of light scattered from a rotating black hole is expected to differ from the initial polarization. A review was made of the evidence for the possibility of the existence of a black hole in a star cluster or a galactic nucleus. An approximate equilibrium distribution function for stars around a large central black hole is given. Dissert. Abstr.

N73-24825 Princeton Univ., N.J.
BARYON NUMBER, ENTROPY, AND BLACK HOLE PHYSICS
Jacob David Bekenstein 1972 189 p
Avail: Univ. Microfilms Order No. 72-29763

A proof is presented which shows that a static or stationary black hole cannot be endowed with any exterior classical meson fields of the type found in nature: scalar, vector, and spin-2. Arguments are given which suggest the same conclusion would follow from a full quantum treatment. It was concluded that in agreement with the Israel-Carter conjecture, every stationary black hole exterior is necessarily of the generalized Kerr type, even when strong interaction effects of the material that went down the black hole are taken into account. A corollary of this conclusion is that the law of conservation of baryon number is transcended in black hole physics. It was also proved that a stationary black hole exterior is the same in Brans-Dicke theory as in general relativity. The effects of high curvature on the form of the equations for nongravitational fields are investigated. Dissert. Abstr.

N73-24826 Michigan Univ., Ann Arbor.
NEW METHODS, SOLUTIONS, AND APPLICATIONS IN THE RESTRICTED THREE-BODY PROBLEM Ph.D. Thesis
Thomas Adolph Heppenheimer 1972 181 p
Avail: Univ. Microfilms Order No. 72-29086

The direct construction of solutions for motion about libration points of the elliptic restricted three-body problem is provided. The solutions involve progressively increasing complexity. The simplest solutions represent the elementary case of linearized motion, and are applied to obtain optimal period controls for out-of-plane motion of a lunar farside libration-point satellite. There is a thorough discussion of the concept, application, and motion of the libration-point satellite, as well as a complete consideration of the practical operation of the proposed period controls. Dissert. Abstr.

N73-24827 Michigan Univ., Ann Arbor.
OPTIMAL GUIDANCE AND MECHANICS OF LOW THRUST SPIRAL TRAJECTORIES Ph.D. Thesis
Robert Arthur Jacobson 1972 158 p
Avail: Univ. Microfilms Order No. 72-29102

The problem of optimal ascent from an initial circular planetary orbit by a low thrust constant thrust acceleration vehicle was investigated. The cases of both spherical and oblate planets were considered, with the latter developed under the assumption that the nondimensional thrust acceleration is of the same order of magnitude as the J2 oblateness coefficient. A two variable asymptotic expansion procedure was used to obtain uniformly valid first order representations of optimal and near optimal trajectories and control programs. Comparisons were made between optimal and near optimal trajectories, and between optimal control programs for the spherical and oblate cases. For all cases the optimal thrust vector was found to be oscillatory with an average direction near that of the velocity vector. The oscillation is shown to be the cause of the high average rate of energy increase which characterizes the optimal trajectory. Dissert. Abstr.

N73-24828# Osservatorio Astronomico, Roma (Italy).
ARABIAN ASTRONOMY AND ITS INFLUENCES [L'ASTRONOMIA ARABA E LA SUA DIFFUSIONE]
Massimo Cimino 1971 31 p In ITALIAN

Avail: NTIS HC $3.75

After a brief history, which begins with the destruction of the library at Alexandria and ends with the Ptolemaic solution for the motions of Mercury and Venus, the astronomy of the Arabs is discussed. Topics discussed include: first developments in Arabian astronomy, astronomical observations and instruments, cosmology, and the natural physics of the celestial sphere. The influence of the Arabian astronomy on Europe is also discussed. Transl. by F.O.S.

N73-24829*# Scientific Translation Service, Santa Barbara, Calif.
STUDY OF THE MOON AND PLANETS BY SPACECRAFT
G. A. Skuridin Washington NASA Apr. 1973 96 p refs Transl. into ENGLISH of the publ. "Izucheniye Luny i Planet Kosmicheskimi Apparatami" Moscow, Znaniye, 1971 p 3-63 (Contract NASw-2035)
(NASA-TT-F-737) Avail: NTIS HC $3.00

The scientific problems involved in designing equipment for space missions to investigate solar system planets are discussed. Achievements in the investigation of the planets by spacecraft are reported. Results of the investigations of the atmospheres and ionospheres of Venus and Mars and physical and mechanical data derived from lunar missions are analyzed. Prospects for the study of the planets of the solar system are predicted. Author

N73-24830*# Intermetrics, Inc., Cambridge, Mass.
A STUDY OF SPACE SHUTTLE ENERGY MANAGEMENT, APPROACH AND LANDING ANALYSIS Final Report
Raymond Morth 9 Apr. 1973 166 p refs
(Contract NAS9-12578)
(NASA-CR-128937) Avail: NTIS HC $10.50 CSCL 22A

The steering system of the space shuttle vehicle is presented for the several hundred miles of flight preceding landing. The guidance scheme is characterized by a spiral turn to dissipate excess potential energy (altitude) prior to a standard straight-in final approach. In addition, the system features pilot oriented control, drag brakes, phugoid damping, and a navigational capacity founded upon an inertial measurement unit and an on-board computer. Analytic formulas are used to calculate, represent, and insure the workability of the system's specifications J.M.M.

N73-24831*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SCO X-1: ORIGIN OF THE RADIO AND HARD X-RAY EMISSIONS
R. Ramaty, C. C. Cheng, and S. Tsuruta (Md. Univ., College Park) May 1973 31 p refs
(NASA-TM-X-66244; X-661-73-126) Avail: NTIS HC $3.75 CSCL 03A

The consequences of models for the central radio source and the hard X-ray (> 30 keV) emitting region in Sco X-1 are examined. It was found that the radio emission could result from noncoherent synchrotron radiation and that the X-rays may be produced by bremsstrahlung. It is shown that both mechanisms require a mass outflow from Sco X-1. The radio source is located at r approximately 3x10 to the 12th power cm from the center of the star, and its linear dimensions do not exceed 3x10 to the 13th power cm. The magnetic field in the radio source is on the order of 1 gauss. If the hard X-rays are produced by thermal bremsstrahlung, their source is located at 10 to the 9th power approximately < r approximately < 5x10 to the 9th power cm, the temperature is 2x10 to the 9th power K, and the emission measure is 2x10 to the 56th power/cu cm. This hot plasma loses energy inward by conduction and outward by supersonic expansion. The rates of energy loss for both processes are about 10 to the 36th power erg/s, comparable to the total luminosity of Sco X-1. Author

N73-24832*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ORBIT DETERMINATION FOR LOW-THRUST SPACECRAFT: CONCEPTS AND ANALYSIS
James P. McDanell 15 Apr. 1973 15 p refs
(Contract NAS7-100)
(NASA-CR-132154; JPL-TM-33-609) Avail: NTIS HC $3.00 CSCL 22C

Earth-based orbit determination capability for SEP spacecraft in multistation tracking and in thrust subsystem error modeling is described. Five different tracking strategies are applied to a 15 day segment of an Encke rendezvous mission. Both optimal and suboptimal orbit determination performance are determined for a wide range of process noise parameter values. The multi-station tracking techniques are found to be extremely effective, reducing orbit determination errors by orders of magnitude over that obtained with conventional single-station tracking. Explicitly differenced multistation data (QVLBI) is found to be least sensitive to gross modeling errors, but if a reasonably good process noise model is available, explicit differencing is not required. Author

N73-24833# Joint Publications Research Service, Arlington, Va.
PRELIMINARY RESULTS OF MEASURING THE H2O CONTENT IN THE ATMOSPHERE OF MARS ON THE MARS-3 AUTOMATIC SPACE STATION
V. I. Moroz, A. E. Nadzhip, A. B. Gilvarg, F. A. Korolev, and V. S. Zheguley 8 Jun. 1973 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 208, no. 4, 1973 p 797-800
(JPRS-59231) Avail: NTIS HC $3.00

The measurement, by the Mars 3 automatic space station, of water content in the Martian atmosphere is discussed. Author

N73-24834*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUMMARY OF THE STUDY OF DISPOSAL OF NUCLEAR WASTE INTO SPACE
Frank E. Rom 1973 14 p refs Presented at 10th Space Congr., Cocoa Beach, Fla., 11-13 Apr. 1973; sponsored by the Canaveral Council of Techn. Soc.
(NASA-TM-X-68235; E-7466) Avail: NTIS HC $3.00 CSCL 18G

The space shuttle together with expendable and nonexpendable orbital stages such as the space tug or Centaur can safely dispose of waste material by ejecting it from the solar system. The safety problems associated with all phases of launching and operation (normal, emergency, and accident) of such a system are being examined. It appears that solutions can be found that should make the risks acceptable when compared to the benefits to be obtained from the disposal of the nuclear waste. The techniques proposed to make such a system acceptable need to be carefully verified by further study and experiment. Author

N73-24835*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ORTHO- AND CLINOPYROXENE COMPOSITIONS IN ORDINARY CHONDRITES AND RELATED BLANDER MODEL CALCULATION PROCEDURES
T. E. Bunch and E. Olsen (Chicago Natural History Museum) Mar. 1973 21 p refs Prepared in cooperation with Chicago Natural History Museum
(NASA-TM-X-62259) Avail: NTIS HC $3.25 CSCL 03B

Chemical analyses of the orthopyroxene and clinopyroxene compositions in chondrites are reported. Standard microprobe techniques to 15 kilovolts, 0.03 microamperes, and 40 second counting time were employed. Duplicate analyses were conducted on three grains of each opx and cpx together with two different raw data correction methods as checks on analytical precision and correction procedures. Only those analytical summations of between 99.20 and 100.80 weight percent, and cation summations between 3.980 and 4.020 (based on 6 oxygens) were used. Author

N73-24836*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPIN SCAN IMAGING AT JUPITER
Kenneth F. Sinclair Apr. 1973 37 p refs
(NASA-TM-X-62260) Avail: NTIS HC $4.00 CSCL 03B

The general feasibility of spin scan imaging from spinning platforms in outer planet orbiters was investigated. The study was limited to consideration of a typical orbiter mission to Jupiter with an orbit designed to provide repetitive close approaches to the Galilean satellites. Discussed are: (1) data requirements for imaging experiments at Jupiter and its satellites; (2) spin scan

camera and baseline camera selection; and (3) operational considerations bearing on imager performance. A physical camera model including relationships identifying the supporting requirements was developed and used to determine the characteristics of the baseline camera. Author

N73-24837*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RATE OF EROSION OF DAYSIDE MAGNETIC FLUX BASED ON A QUANTITATIVE STUDY OF THE DEPENDENCE OF POLAR CUSP LATITUDE ON THE INTERPLANETARY MAGNETIC FIELD
J. L. Burch Jun. 1973 24 p refs Presented at the Chapman Memorial Symp. on Magnetospheric Motions, Boulder, Colo., 18-22 Jun. 1973 Submitted for publication
(NASA-TM-X-66256; X-646-73-163) Avail: NTIS HC $3.25 CSCL 03B

In a consideration of only those periods when the delay time from the interplanetary observing position to the magnetosphere is less than 5 minutes, it is found that, irrespective of substorm activity: (1) The 45 minute average value of interplanetary B(z) predicts the latitudes of the poleward and equatorward boundaries of polar cusp electron precipitation with rms errors of 1.34 deg and 1.16 deg respectively; (2) Both boundaries more equatorward by about 5 deg as B(z) varies from 1 to -6 gammas, the cusp remaining about 40 deg wide; (3) The amount of flux added to the polar cap is about 9.2 percent of the total southward flux impingent on the magnetosphere in the previous 45 minutes; (4) As B(z) becomes more positive, the equatorward boundary moves only slightly more poleward (1/2 deg between B(z) = 2 gammas and B(z) = 6 gammas, while the poleward boundary moves significantly toward higher latitudes, resulting in a cusp approximately 7 deg wide for B(z) = 6 gammas. Author

N73-24838*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR THE PIONEER PROJECT. VOLUME 11 PIONEERS 6-9. EXTENDED MISSIONS: 1 JULY 1971 - 1 JULY 1973
N. A. Renzetti and A. J. Siegmeth 1 May 1973 183 p refs
(Contract NAS7-100)
(NASA-CR-131818; JPL-TM-33-426-Vol-11) Avail: NTIS HC $11.25 CSCL 22C

The Tracking and Data System supported the deep space phases of the Pioneer 6, 7, 8, and 9 missions, with two spacecraft in an inward trajectory and two spacecraft in an outward trajectory from the earth in heliocentric orbits. Scientific instruments aboard each of the spacecraft continued to register information relative to interplanetary particles and fields, and radio metric data generated by the network continued to improve our knowledge of the celestial mechanics of the solar system. In addition to network support activity detail, network performance and special support activities are covered. Author

N73-24839*# Scripta Technica, Inc., Washington, D.C.
INVESTIGATION OF COMPACT SOURCES OF COSMIC RADIO RADIATION AT 35 CM
D. D. Broderick, L. D. Jauncey, V. L. Efanov, K. I. Kellerman, B. G. Clark, L. P. Kogan, V. I. Kostenko, M. N. Cohen, L. I. Matveenko, and I. G. Moiseev NASA Jun. 1973 27 p refs Transl. into ENGLISH of "Issledovanie Kompaktnykh Istochnikov Kosmicheskogo Radioizlucheniya na Volne 3.55 cm", Acad. of Sci., USSR, Inst. for Space Res., Moscow, report PR-117, 1972 37 p
(Contract NASw-2484)
(NASA-TT-F-14698; PR-117) Avail: NTIS HC $3.50 CSCL 03B

Results are presented of observations of compact components of quasars and cores of radio galaxies using a radio interferometer with an angular resolution limit. The measurements were made at 3.55 cm by the ultra-long interferometry method, with the 22-meter radio telescope of KAO, Academy of Sciences, USSR, the 42-meter NRAO (USA) and 64-meter NASA (USA) radio telescopes. The compact components are in most cases complex in structure. Many components have angular dimensions less than 0.00025 in. and linear dimensions 2 light-months. Their temperature brightness exceeds 10 to the 12th power K. The temperature brightness of the resolved components lies between 10 to the 11th power - 10 to the 12th power K. Author

N73-24840*# Scripta Technica, Inc., Washington, D.C.
ALGORITHM FOR COMPUTING SATELLITE ORIENTATION. VALUES OF THE GRAVITATIONAL CONSTANTS
P. E. Elyasberg, V. V. Kugaenko, V. M. Sinitsyn, and V. E. Sokolov NASA Jun. 1973 10 p Transl. into ENGLISH from the Russian Report PR-118
(Contract NASw-2484)
(NASA-TT-F-14699; PR-118) Avail: NTIS HC $3.00 CSCL 22C

An algorithm is presented for computing satellite orientation along with tables of gravitational constants used in the computation. Author

N73-24841*# IIT Research Inst., Chicago, Ill. Astro Sciences.
A SURVEY OF CANDIDATE MISSIONS TO EXPLORE SATURN'S RINGS
William C. Wells and Michael J. Price Jan. 1972 75 p refs
(Contract NASw-2144)
(NASA-CR-132952; M-31) Avail: NTIS HC $5.75 CSCL 22A

The ring system around Saturn is discussed. Exploration of the rings is required for an understanding of their origin and the hazard they represent to spacecraft near Saturn. In addition the rings may provide useful clues to the origin of the solar system. This study examines the problem of ring system exploration and recommends a sequence of missions which will collect the data required. Author

N73-24842*# Analytical Mechanics Associates, Inc., Jericho, N.Y.
ASYMPTOTIC EXPANSION OF AN IMPULSE FOR AN OPTIMAL FINITE BURN
Samuel Pines Mar. 1972 11 p refs
(Contract NAS5-11385)
(NASA-CR-130243; Rept-72-11) Avail: NTIS HC $3.00 CSCL 22C

Closed form expressions are derived for the position and velocity of a spacecraft during a finite burn using the method involving the theory of asymptotic expansion of the optimal impulsive solution. The small parameter is given by the reciprocal of the mass flow rate. The expansion is given in terms of the impulsive solution and holds up through third-order for the velocity and fourth-order for the position. Author

N73-24843*# Analytical Mechanics Associates, Inc., Seabrook, Md.
OPTIMUM THREE IMPULSE TRAJECTORY GENERATOR WITH PATCHED CONIC TRAJECTORY MODEL
Mary H. Payne, Samuel Pines, and Jerry L. Horsewood Apr. 1972 49 p refs
(Contract NAS5-11385)
(NASA-CR-130244; Rept-72-18) Avail: NTIS HC $4.50 CSCL 22C

Optimal multi-impulse trajectories were investigated as a nominal about which asymptotic expansion was used to obtain approximations of optimal low thrust trajectories. The work consisted of the analysis and description of an optimal 3-impulse trajectory program. A patched-conic trajectory model was specifically designed for compatibility with the subsequent addition of the low thrust expansion approximation. Author

N73-24844*# Colorado Univ., Boulder.
SOME EFFECTS OF ELASTICITY ON LUNAR ROTATION
S. J. Peale [1972] 27 p refs
(Grant NGR-05-010-062)
(NASA-CR-132046) Avail: NTIS HC $3.50 CSCL 03B

A general Hamiltonian function for a rotating moon in the field of the earth is expanded in terms of parameters orienting the spin angular momentum relative to the principal axes of the moon and relative to coordinate axes fixed in the orbit plane. The effects of elastic distortion are included as modifications of the moment of inertia tensor, where the magnitude of the distortion is parameterized by the Love number k sub 2. Author

N73-24845*# Purdue Univ., Lafayette, Ind.
VANADIUM ISOTOPIC COMPOSITION AND CONCENTRATIONS OF FERROMAGNESIAN ELEMENTS IN RETURNED LUNAR SAMPLES Final Report
Michael E. Lipschutz Apr. 1973 4 p refs

(Grant NGR-15-005-134)
(NASA-CR-132045) Avail: NTIS HC $3.00 CSCL 03B

The effects are sought of an energetic charged particle irradiation of solar system material which is postulated as having taken place early in its history. A similar irradiation took place much more recently in the history of lunar samples and meteorites and this process is studied by means of a variety of monitors including highly sensitive noble gas nuclides, radionuclides, and tracks. Such monitors cannot be used to study the postulated early irradiation since it could have taken place under conditions such that these monitors were not retained or were subsequently lost. Accordingly, it is necessary that a nongaseous element be used to search for the effects of this irradiation, and one of the most sensitive of these is the vanadium isotopic composition. A comparative study is made of the 50 sub V/51 sub V ratios in 15 meteoritic, 5 terrestrial, and 11 lunar samples. Author

N73-24846# Groupe de Recherches de Geodesie Spatiale, Paris (France).
[SATELLITE TRACKING]
Dec. 1972 40 p refs In FRENCH
(GRGS-Bull-6) Avail: NTIS HC $4.00

Selected papers on artificial satellite translational and rotational motion in the geomagnetic field as well as satellite optical and photographic tracking optimization are presented. For individual titles, see N73-24847 through N73-24848.

N73-24847 Paris Univ. (France). Lab. d'Astronomie.
TRANSLATION-ROTATIONAL MOTION OF A MAGNETIZED SATELLITE IN THE EARTH'S MAGNETIC FIELD [MOUVEMENT DE TRANSLATION ROTATION D'UN SATELLITE AIMANTE DANS LE CHAMP MAGNETIQUE TERRESTRE]
I. Stellmacher *In* Groupe de Rech. de Geodesie Spatiale Bull-6 Dec. 1972 p 1-11 refs In FRENCH (For availability see N73-24846 15-30)

The translational-rotational motion of an axisymmetric satellite in the Newtonian field is studied. Due to the satellite magnetic moment, the effect of geomagnetic field is reduced to a couple and a force acting on the center of gravity. It is shown that in the case of a high satellite magnetization, though the geomagnetic field has an important influence on the satellite attitude, it has no effect on the satellite trajectory. ESRO

N73-24848 Observatoire du Mont-Gros, Nice (France).
TRACKING OF ARTIFICIAL SATELLITES [ETUDE DE LA POURSUITE DES SATELLITES ARTIFICIELS]
Jean-Louis Heudier *In* Groupe de Rech. de Geodesie Spatiale Bull-6 Dec. 1972 p 12-38 In FRENCH (For availability see N73-24846 15-30)

To improve the photographic and laser tracking performance and to give to tracking instruments a motion close to the apparent trajectory of artificial satellites, the equations of motion of a satellite in a topocentric coordinate system were established. The best approximations of the satellite apparent motion were determined using the grand circle and small circle approximations applying them to circular orbits and extending them to the orbit eccentricity. Solutions are proposed for the camera Antares tracking improvement as well as the optimization of laser telemetry. ESRO

N73-24849# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
GLOBAL STRUCTURE OF THE HIGHLY MOBILE EINSTEIN SPACE OF PETROV TYPE T3 RESONANCE
M. E. Osinovskii 1972 10 p refs In RUSSIAN; ENGLISH summary
(ITF-72-117-P) Avail: AEC Depository Libraries

It is shown that the highly mobile Einstein space of type T*3 can be of the following topological types: R4, R3T4,R2T2, R1T3, (R alpha T beta is a topological product of alpha straight lines and beta circles). Author (NSA)

N73-24850# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
GLOBAL PROPERTIES OF COLLAPSING MATTER (BLACK HOLES)
M. A. Markov 1972 49 p refs Presented at 6th Texas Symp. on Relativistic Astrophysics, New York City, 18 Dec. 1972
(JINR-E2-6831; Conf-721207-1) Avail: AEC Depository Libraries

One of the criteria of the existence of fields outside black holes, namely the incompatibility of the presence of the sources of a field with the possible formation of the closed metric, is considered. Some arguments in favor of the existence of the external massive vector (baryon) fields of black holes are given. It is stressed that a correct nonstandard treatment is needed for the problem to be solved rigorously. Author (NSA)

N73-24851# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
ELDO STUDY 13.4: PERFORMANCE ANALYSIS ABOUT A COMBINED CHEMICAL/SOLAR ELECTRIC TRANSFER INTO GEOSTATIONARY ORBIT FOR THE EUROPA 3 LAUNCHER Final Report
Nov. 1971 62 p
(Contract ELDO-CTR-17/4/57; MBB-Proj-R-1206-103-AR6.508.0)
(MBB-UR-V-49-71) Avail: NTIS HC $5.25

Solar electric transfer from high altitude was found to be the best compromise (payload, transfer-time, electrical power) between pure chemical transfer and electrical transfer from low orbit. Parametric performances are computed for Europa 3 launcher plus three possible kickstages (high altitude circularization) which are: ASTRIS, the third stage of Europa 3; TAROS a kickstage based on the French P068 solid motor with auxiliary propulsion system; and LIMOS a liquid propellant module using the ASTRIS vernier motors. These computations give also the optimum conditions for the design of a solar electric propulsion module to be used with a TV satellite. Its critical features are the solar array (part of the satellite itself) using carbon fiber technology and the mercury ion engines. ESRO

N73-24852# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
ORBITAL PARAMETER DETERMINATION BY WEIGHTED LEAST SQUARE ERROR AND KALMAN FILTERING METHODS M.S. Thesis
Joseph J. Pollard Dec. 1972 96 p refs
(AD-757880; GGC/EE/73-13) Avail: NTIS CSCL 22/3

The Extended Kalman Filter and Weighted Least Square Error filtering techniques are used to determine estimates of the classical orbital parameters of a passive near-earth satellite. Modelling of the geopotential is complete through J(sub 6,6). Modelling of the earth's atmosphere includes day-night variations as well as altitude variations. Kalman smoothing is also performed. Both filter techniques were used on a simulated orbit as well as a polar circular orbit and a low perigee eccentric orbit obtained from actual radar data. The determination of the orbital parameters of the simulated orbit yielded an absolute as well as a relative comparison of the filter techniques. The analyses of the orbits determined from actual data yielded a relative comparison of the filter techniques. Comparable results were achieved with both filter techniques. Analyses include discussion of orbital perturbations as well as mean orbital elements. All orbits considered were multi-pass with a limited number of observations per revolution. Author (GRA)

N73-24853*# Owens Valley Radio Observatory, Pasadena, Calif.
THE BRIGHTNESS TEMPERATURE OF VENUS AND THE ABSOLUTE FLUX SCALE AT 608 MHz
D. O. Muhleman, G. L. Berge, and G. S. Orton 1973 14 p refs
(Grant NGR-05-002-114; Contract N00014-67-A-0094-0019; Grant NSF GP-30400)
(AD-756084; Rept-1973-2) Avail: NTIS HC $3.00 CSCL 03/2

The authors measured the disk temperature of Venus at 608 MHz near the inferior conjunction of 1972 and obtained a value of 498 plus or minus 33K using a nominal CKL flux density scale. The result is consistent with earlier measurements, but has a much smaller uncertainty. Our theoretical model prediction is larger by a factor of 1.21 plus or minus 0.09. This discrepancy has been noticed previously for frequencies below 1400 MHz, but was generally disregarded because of the large observational uncertainties. Author (GRA)

N73-24854# Owens Valley Radio Observatory, Pasadena, Calif.
APERTURE SYNTHESIS OF INTERSTELLAR NEUTRAL HYDROGEN IN ABSORPTION. 1: THE PERSEUS ARM FEATURE OF CASSIOPEIA A
Eric W. Greisen 1973 43 p refs
(Contracts N00014-67-A-0094-0019)
(AD-757687; Rept-1973-1) Avail: NTIS CSCL 03/2

The Owens Valley Radio Observatory interferometer was used to carry out a program of aperture synthesis in the interstellar neutral hydrogen absorption line. Maps having resolutions of 0.2 km/s and about 1.3 arc minutes were produced using a novel Fourier inversion method. This paper is devoted to discussions of the observing and analyzing procedures and of the results for the Perseus arm feature in the spectrum of Cassiopeia A. (Author Modified Abstract) GRA

N73-24855# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
SOLAR ACTIVITY IN Mc MATH REGION 10789 DURING DISK PASSAGE, 12 TO 15 JUNE 1970
Anne L. Carrigan and John P. Castelli 16 Nov. 1972 31 p refs
(AD-756827; AFCRL-72-0669; AFCRL-PSRP-528) Avail: NTIS CSCL 03/2

Less than half a dozen longitude-identified active regions in the (current) 20th sunspot cycle produced 90 or more solar eruptions during disk passage. Besides a high flare-burst productivity, each of these was identified with energetic particle emission. A recent one of these regions was centered around longitude 226 degrees (17 degrees N latitude) in Mc Math region 10789, with central meridian passage on 16.8 June 1970. It is shown that the region which spawned an unusually high burst-to-flare ratio on 13 June had the maximum radio brightness at both 10.7 and 20 cm lambda in this brief interval. (Author Modified Abstract) GRA

N73-24856# Owens Valley Radio Observatory, Pasadena, Calif.
NEUTRAL HYDROGEN APERTURE SYNTHESIS MAPS OF IC2574 AND NGC 7640
G. A. Seielstad and M. C. H. Wright 1973 23 p refs
(Contract N00014-67-A-0094-0019)
(AD-757688; Rept-1973-5) Avail: NTIS CSCL 03/2

Aperture synthesis observations with an angular resolution about 2 arc-min of two late-type galaxies have revealed HI distributions some 1.5 times larger than their photographic images. IC2574, classified as an irregular galaxy, has a well organized velocity field typical of a late spiral galaxy. The major HI concentrations do not correspond with the brightest optical features. A ridge of peculiar velocities of about 10 km/s in the region of the optical bar may indicate streaming motions of gas along the bar. NGC7640 is an SBc galaxy at an inclination of 77 degrees. There is no evidence of any HI halo brighter than 100 degrees K km/s, although there is a suggestion of warping of the plane of the HI layer. Author (GRA)

N73-24857# Owens Valley Radio Observatory, Pasadena, Calif.
INTRODUCTION TO VERY-LONG-BASELINE INTERFEROMETRY
M. H. Cohen 1973 31 p refs
(Contract N00014-67-A-0094-0019; Grants NSF GP-30400; NSF GP-19400)
(AD-757690; Rept-1973-7) Avail: NTIS CSCL 03/2

Long baseline interferometry achieves high angular resolution by using two (or more) widely separated radio telescopes and recording video signals on magnetic tapes, which are later brought together and cross-correlated. This paper contains discussions of the coherence and timing requirements, and of calibration procedures. Applications to measuring brightness distributions and to spectroscopy are reviewed briefly. Some pertinent phenomena connected with radio wave scattering in irregular media are discussed. Author (GRA)

N73-24858# Owens Valley Radio Observatory, Pasadena, Calif.
HIGH FREQUENCY OBSERVATIONS AND THEORETICAL INTERPRETATION OF RECOMBINATION LINE EMISSION IN THE DIRECTION OF THE SUPERNOVA REMNANT 3 C391
Diego A. Cesarsky and Catherine J. Cesarsky 1973 26 p refs
(Contract N00014-67-A-0094-0019; Grants NSF GP-30400; NSF GP-23780)
(AD-756085; Rept-1973-3) Avail: NTIS CSCL 03/2

The comparison of radio recombination line intensities and the amount of low frequency absorption along the same line of sight provides a unique method of obtaining information on the electron temperature of the regions involved. This method, when applied to high frequency line observations in the direction of the remnant 3C391, suggests that the line emission originates in regions having an electron temperature Te < 300K, and a most probable value of Te = 20K. Author (GRA)

N73-24859# Owens Valley Radio Observatory, Pasadena, Calif.
ACCURATE POSITIONS OF OH EMISSION SOURCES AT 1665 AND 1667 MHz
W. M. Gross (Max Planck Inst.), I. A. Lockhard, E. B. Fomalont (Natl. Radio Astronomy Obs.), and Ellen G. Hardebeck 1973 22 p refs
(Contract N00014-67-A-0094-0019; Grant NSF GP-30400)
(AD-756086; Rept-1973-4) Avail: NTIS CSCL 03/2

Accurate positions of 8 OH emission sources have been measured at 1665 and 1667 MHz. The Owens Valley interferometer was used at spacings of 366 and 488 m north-south. Near the continuum sources G45.1 - 0.1 and G45.5 - 0.1, four separate OH emission regions have been found. Author (GRA)

N73-24860# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
ASTRONOMY RESEARCH AT THE AEROSPACE CORPORATION Research Report, 1 Jan. - 31 Dec. 1972
George A. Paulikas, comp. 29 Dec. 1972 19 p
(Contract F07401-72-0073)
(AD-756459; TR-0073(3260-01)-1; SAMSO-TR-73-42) Avail: NTIS CSCL 03/2

The report reviews the astronomy research carried out at The Aerospace Corporation during 1972. (Author Modified Abstract) GRA

N73-24861# Owens Valley Radio Observatory, Pasadena, Calif.
CONCERNING ANOMALOUS FORMALDEHYDE HYPERFINE LINES IN THE DUST CLOUD L1436
Richard M. Crutcher 1973 12 p refs
(Contract N00014-67-A-0094-0019)
(AD-757689; Rept-1973-6) Avail: NTIS CSCL 03/2

The authors show that there is no evidence of nonequilibrium hyperfine component intensities of formaldehyde in the dust cloud L1436. Author (GRA)

N73-24862# Aerospace Corp., El Segundo, Calif. Lab. Operations.
RADIO AND OPTICAL ACTIVITY OF THE PECULAR OBJECT BL LAC (VRO 42.22.01) AND 3.3-mm OBSERVATIONS OF CYGNUS X-3, FEBRUARY 1968 - JULY 1972
Eugene E. Epstein, Richard B. Pomphrey, Richard L. Hackney, Karen R. Hackney, and Alex G. Smith 15 Jan. 1973 22 p refs
(Contract F04701-72-C-0073)
(AD-756464; TR-0073(9230-30)-2; SAMSO-TR-72-303) Avail: NTIS CSCL 03/2

In late 1971, BL Lac underwent an isolated optical flare of a type previously observed in optically violent (OVV) quasars. Although this event was followed in 55 days by a similar radio flare, an examination of all available data indicates that the observations cannot be correlated by the assumption of a constant radio-optical delay. The 3-mm measurements of the giant radio outburst of Cygnus X-3 during early September 1972 are presented. Author (GRA)

N73-24863*# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
SPECIAL REPORT, A BRIEF HISTORY OF DATA AND THEORY PERTAINING TO THE ATMOSPHERE OF THE MOON
G. E. Thomas 5 May 1972 16 p refs
(Contract NAS9-11528)
(NASA-CR-128548; T72-19301) Avail: NTIS HC $3.00 CSCL

03B

A brief historical account of data and theory pertaining to the lunar atmosphere prior to the Apollo program is presented. It consists of a summary of the most important pre-Apollo research, rather than an exhaustive bibliographical study, and constitutes a supporting analytical study for the Apollo 17 UV Spectrometer Experiment. Author

N73-24864*# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
SPECIAL REPORT, DIFFUSE REFLECTIVITY OF THE LUNAR SURFACE
William G. Fastie 15 Jan. 1972 103 p refs
(Contract NAS9-11528)
(NASA-CR-128546; T72-19298) Avail: NTIS HC $7.25 CSCL 03B

The far ultraviolet diffuse reflectivity of samples of lunar dust material is determined. Equipment for measuring the diffuse reflectivity of materials (e.g. paint samples) is already in existence and requires only minor modification for the proposed experiment which will include the measurement of the polarizing properties of the lunar samples. Measurements can be made as a function of both illumination angle and angle of observation. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also; 28 Propulsion Systems; and 32 Structural Mechanics.

N73-24865*# Boeing Aerospace Co., Seattle, Wash.
SPACE VEHICLE INTEGRATED THERMAL PROTECTION/ STRUCTURAL/METEOROID PROTECTION SYSTEM, VOLUME 1 Final Report
D. H. Bartlett and D. K. Zimmerman Apr. 1973 397 p refs
(Contract NAS3-13316)
(NASA-CR-121103; D180-15172-1) Avail: NTIS HC $22.00 CSCL 22B

A program was conducted to determine the merit of a combined structure/thermal meteoroid protection system for a cryogenic vehicle propulsion module. Structural concepts were evaluated to identify least weight designs. Thermal analyses determined optimum tank arrangements and insulation materials. Meteoroid penetration experiments provided data for design of protection systems. Preliminary designs were made and compared on the basis of payload capability. Thermal performance tests demonstrated heat transfer rates typical for the selected design. Meteoroid impact tests verified the protection characteristics. A mockup was made to demonstrate protection system installation. The best design found combined multilayer insulation with a truss structure vehicle body. The multilayer served as the thermal/meteoroid protection system. Author

N73-24866*# Boeing Aerospace Co., Seattle, Wash.
SPACE VEHICLE INTEGRATED THERMAL PROTECTION/ STRUCTURAL/METEOROID PROTECTION SYSTEM, VOLUME 2 Appendixes to Final Report
D. H. Bartlett and D. K. Zimmerman Apr. 1973 280 p
(Contract NAS3-13316)
(NASA-CR-121104; D180-15172-2) Avail: NTIS HC $16.00 CSCL 22B

For abstract, see N73-24865.

N73-24867*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HYPERVELOCITY IMPACT TESTING OF L-BAND TRUSS CABLE METEOROID SHIELDING ON SKYLAB
David W. Jex 23 Feb. 1973 19 p
(NASA-TM-X-64743) Avail: NTIS HC $3.00 CSCL 22B

A series of tests was performed to determine the protection provided by the L-band truss cable meteoroid shielding installed on Skylab space station at space environment temperatures of minus 180 F. The damage sustained when three test specimens were impacted by spherical projectiles at hypersonic speed was investigated. It is concluded that the L-band truss cable meteoroid shielding provides adequate protection at the indicated temperature. Author

N73-24868*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF CERTAIN CONTROL-SYSTEM NONLINEARITIES ON STABILITY AND POINTING OF AN ATTACHED DOUBLE-GIMBAL EXPERIMENT PACKAGE IN PRESENCE OF RANDOM CREW-MOTION DISTURBANCES
John D. Shaughnessy, Nelson J. Groom, and Vilas D. Nene Washington May 1973 45 p refs
(NASA-TN-D-7247; L-7899) Avail: NTIS HC $3.00 CSCL 22B

The effects of two types of control-system nonlinearities, sensor deadband and actuator breakout torque, on the pointing capability of a Apollo Telescope Mount (ATM) double-gimbal experiment isolation and control system are investigated. A composite structural model of a flexible experiment package connected through frictionless double gimbals to a flexible carrier vehicle is used for this investigation. Contributions of the primary carrier control system to experiment pointing are neglected. Pointing errors onboard the experiment package due to random crew-motion input into the carrier vehicle are computed. A stability investigation is performed to verify control-system stability with nominal nonlinearities and gains. Indications are that there is no stability problem due to the nonlinearities. A nonlinearity sensitivity study is carried out to determine the effects on pointing accuracy. Its results indicate that nominal ATM control system nonlinearities limit the pointing accuracy to approximately 0.4 arc second in the presence of crew motion. Methods of reducing the error to less than 0.1 arc second are discussed. Author

N73-24869*# North American Rockwell Corp., Downey, Calif. Space Div.
SHUTTLE/TYPICAL PAYLOAD INTERFACE STUDY Final Report
J. M. Mansfield 30 Oct. 1972 111 p refs
(Contract NAS5-23093)
(NASA-CR-130239; SD-72-SA-0194) Avail: NTIS HC $7.75 CSCL 22B

Concept synthesis and preliminary design studies are summarized of support systems to implement the launch/ refurbishment/retrieval with shuttle of a family of low cost earth observation satellites in low earth orbit. Shuttle constraints and issues are described. Author

N73-24870*# Wisconsin Univ., Madison. Space Science and Engineering Center.
METEOROLOGICAL MEASUREMENTS FROM SATELLITE PLATFORMS Annual Scientific Report, 1971 - 1972
Verner E. Suomi Dec. 1972 212 p refs
(Contract NAS5-11542)
(NASA-CR-130246) Avail: NTIS HC $12.75 CSCL 22C

Quantitative exploitation of meteorological data from geosynchronous satellites is starting to move from the laboratory to operational practice. Investigations of the data applications portion of the total meteorological satellite system include: (1) tropospheric wind shear and the related severe storm circulations; (2) kinematic properties of the tropical atmosphere as derived from cloud motion vectors; (3) application of a geostationary satellite rake system to measurements of rainfall; and (4) pointing error analysis of geosychronous satellites. Author

N73-24871*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
INTEGRATED DIGITAL FLIGHT-CONTROL SYSTEM FOR THE SPACE SHUTTLE ORBITER
Mar. 1973 221 p
(Contract NAS9-11764)
(NASA-CR-128936; E-2736) Avail: NTIS HC $13.25 CSCL 22B

The integrated digital flight control system is presented which provides rotational and translational control of the space shuttle orbiter in all phases of flight: from launch ascent through orbit to entry and touchdown, and during powered horizontal flights. The program provides a versatile control system structure while maintaining uniform communications with other programs,

sensors, and control effectors by using an executive routine/functional subroutine format. The program reads all external variables at a single point, copies them into its dedicated storage, and then calls the required subroutines in the proper sequence. As a result, the flight control program is largely independent of other programs in the GN&C computer complex and is equally insensitive to the characteristics of the processor configuration. The integrated structure of the control system and the DFCS executive routine which embodies that structure are described along with the input and output. The specific estimation and control algorithms used in the various mission phases are given. Author

N73-24872*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DYNAMICAL MODELS FOR A SPACECRAFT IDEALIZED AS A SET OF MULTI-HINGED RIGID BODIES
V. Larson 1 May 1973 86 p refs
(Contract NAS7-100)
(NASA-CR-132155; JPL-TM-33-613) Avail: NTIS HC $6.50 CSCL 22B

A brief description is presented of a canonical set of equations which governs the behavior of an n-body spacecraft. General results are given for the case in which the spacecraft is modeled in terms of n rigid bodies connected by dissipative elastic joints. The final equations are free from constraint torques and involve only r variables (r is the number of degrees of freedom of the system). An advantage which accompanies the elimination of the constraint torques is a decrease in the computer run time (especially when n is large). Author

N73-24873*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: GUIDANCE AND CONTROL SYSTEMS. ENGINEERING SIMULATION PROGRAM
David W. Gilbert Washington Jun. 1973 14 p
(NASA-TN-D-7287; MSC-S-318) Avail: NTIS HC $3.00 CSCL 22B

The Apollo Program experience from early 1962 to July 1969 with respect to the engineering-simulation support and the problems encountered is summarized in this report. Engineering simulation in support of the Apollo guidance and control system is discussed in terms of design analysis and verification, certification of hardware in closed-loop operation, verification of hardware/software compatibility, and verification of both software and procedures for each mission. The magnitude, time, and cost of the engineering simulations are described with respect to hardware availability, NASA and contractor facilities (for verification of the command module, the lunar module, and the primary guidance, navigation, and control system), and scheduling and planning considerations. Recommendations are made regarding implementation of similar, large-scale simulations for future programs. Author

N73-24874*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: POTABLE WATER SYSTEM
Richard L. Sauer and David J. Calley Washington Jun. 1973 16 p
(NASA-TN-D-7291; MSC-07508) Avail: NTIS HC $3.00 CSCL 06K

A description of the design and function of the Apollo potable water system is presented. The command module potable water is supplied as a byproduct of the fuel cells. The cells, located in the service module, function primarily to supply electrical energy to the spacecraft. The source of the lunar module potable water is three tanks, which are filled before lift-off. The technique of supplying the water in each of these cases and the problems associated with materials compatibility are described. The chemical and microbiological quality of the water is reviewed, as are efforts to maintain the water in a microbially safe condition for drinking and food mixing. Author

N73-24875*# Hamilton Standard, Windsor Locks, Conn.
SPACE SHUTTLE EVA/IVA SUPPORT EQUIPMENT REQUIREMENTS STUDY. VOLUME 1: FINAL SUMMARY REPORT Final Summary Report, 14 Mar. 1972 - 30 Apr. 1973
30 Apr. 1973 347 p ref 2 Vol.
(Contract NAS9-12506)
(NASA-CR-128941; SP-01T73-Vol-1) Avail: NTIS HC $19.50 CSCL 22B

A study was conducted to determine the support equipment requirements for space shuttle intravehicular and extravehicular activities. The subjects investigated are; (1) EVA/IVA task identification and analysis,. (2) primary life support system, (3) emergency life support system, (4) pressure suit assembly, (5) restraints, (6) work site provision, (7) emergency internal vehicular emergencies, and (8) vehicular interfaces. Author

N73-24876*# Hamilton Standard, Windsor Locks, Conn.
SPACE SHUTTLE EVA/IVA SUPPORT EQUIPMENT REQUIREMENTS STUDY. VOLUME 2: APPENDIX Final Summary Report, 14 Mar. 1972 - 30 Apr. 1973
30 Apr. 1973 344 p refs 2 Vol.
(Contract NAS9-12506)
(NASA-CR-128942; SP-01T73-Vol-2) Avail: NTIS HC $19.25 CSCL 22B

For abstract, see N73-24875.

N73-24877*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TITAN/CENTAUR: NASA'S NEWEST LAUNCH VEHICLE
Andrew J. Stofan 1973 14 p refs Presented at Space Mission Planning and Executive Meeting for the Launch Vehicle Issues Sect., Denver, Colo., 10-11 Jul. 1973; sponsored by Am. Inst. of Aeron. and Astronautics, Am. Soc. of Mech. Engr., and the Soc. of Automotive Engr.
(NASA-TM-X-68249; E-7505) Avail: NTIS HC $3.00 CSCL 22B

Titan/Centaur is NASA's last new expendable launch vehicle prior to the advent of the space shuttle. Titan/Centaur is an adaptation of the Air Force Titan 3 booster with an improved version of the Centaur stage and a new 4.2 meters payload fairing. Titan/Centaur is initially being used for high performance escape missions (Helios Solar Probe - 340 kilograms' Viking Mars Orbiter and Lander - 3,629 kilograms, and Mariner Jupiter/Saturn Fly-Bys at 771 kilograms, but is also particularly suited for larger spacecraft in synchronous orbits (transfer - 7,031 kilograms and equatorial, with three Centaur burns - 3,175 kilograms). The program which began in 1965 with internal NASA feasibility studies will culminate in a proof flight launch in early 1974. With the new payload fairing, which also encloses Centaur, payloads of nearly 8.5 meters long and 3.8 meters in diameter can be accommodated. Author

N73-24878# Toronto Univ. (Ontario).
DYNAMICS OF LARGE FLEXIBLE SOLAR ARRAYS AND APPLICATION TO SPACECRAFT ATTITUDE CONTROL SYSTEM DESIGN
P. C. Hughes and S. C. Garg Feb. 1973 260 p refs
(UTIAS-179) Avail: NTIS HC $15.00 CSCL 22B

The dynamic characteristics of large flexible solar arrays and the resulting interaction between spacecraft attitude dynamics and the elastic degrees of freedom are discussed. The representation of these additional degrees of freedom in terms of natural modes is presented and two classes of modes are defined. For both classes, the object of the analysis is to find the natural frequencies of oscillation and the modal gains. Numerical results are provided for frequencies and gains for both classes of modes and their dependence on all satellite parameters is exhibited graphically. Author

N73-24879# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
INVESTIGATION OF A SOLID APOGEE STAGE FOR EUROPA 3 [UNTERSUCHUNGEN ZU EINER FESTSTOFF-APOGAEUMSSTUFE FUER EUROPA 2]
May 1971 98 p refs In GERMAN; ENGLISH summary
(Contract ELDO-CTR-17/4/34)
Avail: NTIS HC $7.00

The design of an apogee kickstage which could be associated with Europa 3 launcher for injecting payloads into the geostationary orbit (36.00 km) is studied. This apogee system is based on the use of the existing perigee motor of Europa 2, a spin

stabilized solid propellant motor with 685 kg propellant. For its use together with Europa 3, it is required to have a three axis-stabilization system. The performance, the layout of the stage, the constructive design and the design of the stabilization system are the subject of this study. It is shown that the existing perigee motor could be used as an apogee kickstage for Europa 3 with nevertheless a significant loss of payload. ESRO

N73-24880# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
ELDO FEASIBILITY STUDY: SPACE VEHICLE PROPELLED BY A NUCLEOTHERMAL ENGINE. INTEGRATION AND MISSION ANALYSIS [ETUDE DE FAISABILITE: VEHICULE SPATIAL A PROPULSION NUCLEO-THERMIQUE. INTEGRATION ET ANALYSE DE MISSION]
4 Jul. 1972 115 p refs In FRENCH
(Contract ELDO-CTR-17/4/48)
(TR-T/T-1.2-7/72) Avail: NTIS HC $7.75

A nuclear rocket engine has been studied for an upper stage of the two-stage Europa 3 launch vehicle. The reactor is fuelled by uranium carbide and oxide pellets with suitable coatings. Hydrogen, stored in the liquid state, conveyed by a turbopump, flow through the reactor core acquiring a high temperature. Several configurations for the reactor are described. The structure of the nuclear stage is further designed to subsystem level and its integration with in Europa 3 considered. Performances for geosynchronous and planetary missions are calculated. A nuclear third stage for Europa 3, having an initial mass of 5.5 would allow to place 1650 kg payload in geostationary orbit. ESRO

N73-24881# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, FEBRUARY 1973
R. D. Eberst 15 Mar. 1972 31 p
(ROE-STS-147) Avail: NTIS HC $3.75

Stopwatch observations made at stations connected with the Section during February 1973 are listed in launch and time order for each satellite. Various sub-totals are given.
Author (ESRO)

N73-24882# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
KINETHEODOLITE OBSERVATIONS MADE AT EARLYBURN DURING THE PERIOD FROM 2-10 MARCH 1966
K. S. Russell 26 Mar. 1972 34 p ref
(ROE-STS-148) Avail: NTIS HC $3.75

Timed observations of satellites, made in azimuth and elevation with a cinetheodolite at Earlyburn Outstation, are listed in launch and time order for each satellite. Author (ESRO)

N73-24883# Avco-Everett Research Lab., Everett, Mass.
ELECTRIC PROBE DATA ANALYSIS FOR TRAILBLAZER 2, THIRD FLIGHT
Ronlad A. Johnson 21 Nov. 1972 61 p refs
(Contract F19628-72-C-0102; AF Proj. 4642)
(AD-758763; AVSD-0461-72-CR; AFCRL-72-0732; SR-2) Avail: NTIS CSCL 16/3

The ion current measured by flush mounted electric probes is compared with that predicted from flow field calculations for the Trailblazer 2 over an altitude range from 220 Kft to 270 Kft. Various approaches, all of which assumed the sheath to be collision-dominated were used to infer ion currents from the flow field predictions. Except for current traces associated with those probes located on the nose cap at 270 Kft, the experimental results were bound from above by the total convective current in the boundary layer and from below by a quasi-one-dimensional current or a diffusion current. The inclusion of convective effects helps provide agreement between theory and experiment for some of the higher altitude data. But over the altitude range considered, it is evident that no simple theory in which it is assumed that either convection, diffusion or a thermal flux respectively is the dominant mechanism for transporting ions into the sheath, produces results consistent with the data. The ion transport phenomena are too complex to be described by such simple theories. Author (GRA)

N73-24676 Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
PRELIMINARY DEFINITION OF THE STRUCTURE [DEFINITION PRELIMINAIRE DE LA STRUCTURE]
Kohl *In its* Space Vehicle Propelled by a Nucleothermal Engine 25 Jun. 1972 18 p In FRENCH (For availability see N73-24675 15-22)
(Contract ELDO-CTR-17/4/48)
(TR-TK-Ref-1-374/72)

N73-24677 Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
PRELIMINARY STUDY OF THE ELECTRICAL EQUIPMENT
Weber *In its* Space Vehicle Propelled by a Nucleothermal Engine 25 Jun. 1972 15 p (For availability see N73-24675 15-22)
(Contract ELDO-CTR-17/4/48)
(TR-TT-4-16/72)

N73-24679 Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
PRELIMINARY STUDY OF NUCLEAR RADIATION SHIELDING
Borchardt *In its* Space Vehicle Propelled by a Nucleothermal Engine 25 Jun. 1972 64 p (For availability see N73-24675 15-22)
(Contract ELDO-CTR-17/4/48)
(TR-TT-4-18/72)

N73-24680 Stuttgart Univ. (West Germany). Inst. fuer Kernenergetik.
SHIELDING CALCULATION OF A NUCLEAR PROPELLED SPACE VEHICLE (10 MW) Final Report
In ERNO Raumfahrttech. Space Vehicle Propelled by a Nucleothermal Engine 14 Dec. 1971 12 p (For availability see N73-24675 15-22)
(TN-3-25)

N73-24970 European Space Research and Technology Center, Noordwijk (Netherlands).
ORGANIZATION AND MANAGEMENT OF THE ESRO 4 SATELLITE PROJECT
Jean-Francois Lafay *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 77-87 (For availability see N73-24962 15-31)

N73-24973 European Space Research and Technology Center, Noordwijk (Netherlands). Satellites and Sounding Rockets Dept.
SYSTEMS ENGINEERING AND PROJECT MANAGEMENT OF THE ESRO 1 SATELLITE
Manfred G. Grensemann *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 109-128 (For availability see N73-24962 15-34)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N73-24884 National Lending Library for Science and Technology, Boston Spa (England).
NUMERICAL CALCULATION OF THE BOUNDARY PROBLEM FOR NON-SYMMETRICAL DEFORMATION OF STRUCTURALLY ANISOTROPIC SHELLS OF REVOLUTION
A. P. Zindman 1973 8 p refs Transl. into ENGLISH from Prikl. Mekh. (USSR), v. 4, 1968 p 121-123
(NLL-DRIC-Trans-2996-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A finite difference method is applied to the calculation of the boundary value problem for random shells of revolution in unsymmetrically loaded conditions. The computer program makes it possible to investigate closed shells of revolution of variable thickness, strengthened by a system of nonsymmetrical, merid-

ian ribs of variable rigidity. Mathematical models are provided to support the theoretical considerations. Author

N73-24885 National Lending Library for Science and Technology, Boston Spa (England).
TORSION OF A NONHOMOGENEOUS BAR WITH SECTIONS IN THE SHAPE OF ANNULAR OR CIRCULAR SECTOR
S. G. Lekniskii 1973 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR Mekh. Tverdogo Tfla (USSR), v. 1, 1971 p 71-75
(NLL-DRIC-Trans-2995-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The torsion characteristics of a bar of constant section in the shape of part of a circular ring or in the form of a circular sector are analyzed. It is assumed that the material possesses cylindrical anistropy and is orthotropic and inhomogeneous. The solution is based on the assumption of the Saint-Venant torsion theory which makes it possible to satisfy strictly the conditions on the lateral surfaces, and to satisfy them approximately on the end faces. The stress function is sought in the form of a series which it defines explicitly for cases of power dependence of the shear moduli on the coordinate and constant moduli.
Author

N73-24886 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF RIGIDITY OF CONFIGURATION OF THE STRESSED STATE ON CORROSION CRACKING
O. I. Steklov 13 Mar. 1973 9 p refs Transl. into ENGLISH from Zaschita Metal. (Moscow), v. 8, no. 3, May-Jun. 1972 p 326-329 In ENGLISH and RUSSIAN
(NLL-LTI-746-1413-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The stressed state of shell construction and its effect on corrosion cracking is discussed. The principal investigation concerns the action of an applied stress or of residual stresses in welded joints. The stability of both the welded joints and the base metal was studied. The welding was performed in argon using nonconsumable tungsten electrodes. Author

N73-24887 Michigan Univ., Ann Arbor.
FREE AND FORCED VIBRATION OF A THIN CYLINDRICAL SHELL Ph.D. Thesis
Bruce William Butske 1972 81 p
Avail: Univ. Microfilms Order No. 72-29010

Flugge equations of motion are used to study the vibration frequencies of a cantilever and an elastically supported-free thin circular cylindrical shell. A computer program has been developed for the numerical solution of the eighth degree polynomial and the evaluation of the eight by eight determinant that arises in connection with the study. Curves of lowest frequency (a triplet exists) versus cantilever shell length are presented for two circumferential mode numbers. The elastic support which corresponds to a continuous distribution of torsional springs around the shell edge was found to have little effect on the frequencies for the circumferential mode studied. For beam-mode transient response of a thin cylindrical shell, conditions under which an Euler-Bernoulli beam representation is adequate are used.
Dissert. Abstr.

N73-24888 Polytechnic Inst. of Brooklyn, N.Y.
VIBRATIONS OF RING-STIFFENED TOROIDAL SHELLS Ph.D. Thesis
Theodore Balderes 1972 259 p
Avail: Univ. Microfilms Order No. 72-28206

The free vibrations of ring stiffened toroidal shells are studied. The stiffening rings which are assumed placed at meridional sections, are treated as discrete members. Moreover, an arbitrary number of rings differing in properties and unequally spaced is considered. The shell segments, whose motion is accounted for within the linear shell theory, are coupled to the stiffeners by imposing compatibility at the junctions. The Love-Reissner shell theory is employed for analyzing the torus segments. The shell equations are first converted into a set of eight partial differential equations with variable coefficients, expressing the first derivatives, in the circumferential direction, of the eight shell functions which appear in the natural boundary conditons at a meridional section.
Dissert. Abstr.

N73-24889 Polytechnic Inst. of Brooklyn, Farmingdale, N.Y.
STATIC, BUCKLING AND VIBRATION CHARACTERISTICS OF ORTHOTROPIC NONHOMOGENEOUS SHELLS OF REVOLUTION Ph.D. Thesis
Omer Ali Fettahlioglu 1972 213 p
Avail: Univ. Microfilms Order No. 72-28229

Systematic procedures to study the static, buckling, and vibration behavior of orthotropic layered thin shells of revolution of variable thickness and of variable orthotropic properties along the meridian and through the thickness of the shell are discussed. The dissertation contains two sections. In the first section, which deals with the static problem, the shell is subjected to axisymmetrical load and temperature distributions. The effect of the geometric nonlinearity of the change in the meridional slope, the so-called pressurization effect, is taken into consideration. In the second section, which deals with the vibration problem, the equations of motion of the orthotropic nonhomogeneous shells of revolution (including the effects of pressurization, transverse shear stress, and rotatory inertia) are formulated in terms of a system of six first-order simultaneous partial differential equations involving only one derivative with respect to the space variable.
Dissert. Abstr.

N73-24890# Aeronautical Research Labs., Melbourne (Australia).
COMPARISON OF YIELDING AND ELASTIC RESTRAINT SYSTEMS FOR CRASH PROTECTION
S. R. Sarrailhe Oct. 1972 27 p refs
(ARL/SM-382) Avail: NTIS HC $3.50

A comparison of the effectiveness of yielding and elastic restraint systems for crash protection was conducted. Mathematical models of elastic and yielding restraint systems were developed to show the effects of slack and yield at constant load. For a given peak restraint load it was shown that one inch of slack could reduce the allowable vehicle deceleration by 20 percent, but that 8 to 12 inches of yield could double the allowable vehicle deceleration. It was concluded that the performance of crash protective seat belts can be improved by the incorporation of energy absorbers which allow the restraint to yield at constant load.
Author

N73-24891*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THREE-DIMENSIONAL ELASTIC STRESS AND DISPLACEMENT ANALYSIS OF FINITE CIRCULAR GEOMETRY SOLIDS CONTAINING CRACKS
John P. Gyekenyesi, Alexander Mendelson, and Jon Kring Washington May 1973 47 p refs
(NASA-TN-D-7266; E-7258) Avail: NTIS HC $3.00 CSCL 20K

A seminumerical method is presented for solving a set of coupled partial differential equations subject to mixed and coupled boundary conditions. The use of this method is illustrated by obtaining solutions for two circular geometry and mixed boundary value problems in three-dimensional elasticity. Stress and displacement distributions are calculated in an axisymmetric, circular bar of finite dimensions containing a penny-shaped crack. Approximate results for an annular plate containing internal surface cracks are also presented.
Author

N73-24892*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
FLIGHT INVESTIGATION OF XB-70 STRUCTURAL RESPONSE TO OSCILLATORY AERODYNAMIC SHAKER EXCITATION AND CORRELATION WITH ANALYTICAL RESULTS
James M. McKay, Eldow E. Kordes, and John H. Wykes (N. Am. Rockwell Corp., Los Angeles) Washington Apr. 1973 124 p refs
(NASA-TN-D-7227; H-713) Avail: NTIS HC $3.00 CSCL 01C

The low frequency symmetric structural response and damping characteristics of the XB-70 airplane were measured at four flight conditions: heavyweight at a Mach number of 0.87 at an altitude of 7620 meters (25,000 feet); lightweight at a Mach number of 0.86 at an altitude of 7620 meters (25,000 feet); a

Mach number of 1.59 at an altitude of 11,918 meters (39, 100 feet); and a Mach number of 2.38 and an altitude of 18,898 meters (62,000 feet). The flight data are compared with the response calculated by using early XB-70 design data and with the response calculated with mass, structural, and aerodynamic data updated to reflect as closely as possible the airplane characteristics at three of the flight conditions actually flown.
Author

N73-24893*# Boeing Commercial Airplane Co., Seattle, Wash.
BUCLASP 2: A COMPUTER PROGRAM FOR INSTABILITY ANALYSIS OF BIAXIALLY LOADED COMPOSITE STIFFENED PANELS AND OTHER STRUCTURES
L. L. Tripp, M. Tamekuni, and A. V. Viswanathan Mar. 1973 172 p refs
(Contract NAS1-8858)
(NASA-CR-112226) Avail: NTIS HC $10.75 CSCL 20K

The use of the computer program BUCLASP2 is described. The program is intended for linear instability analyses of structures such as unidirectionally stiffened panels. Any structure that has a constant cross section in one direction, that may be idealized as an assemblage of beam elements and laminated flat and curved plant strip elements can be analyzed. The loadings considered are combinations of axial compressive loads and in-plane transverse loads. The two parallel ends of the panel must be simply supported and arbitrary elastic boundary conditions may be imposed along any one or both external longitudinal side. This manual consists of instructions for use of the program with sample problems, including input and output information. The theoretical basis of BUCLASP2 and correlations of calculated results with known solutions, are presented. Author

N73-24894*# Boeing Commercial Airplane Co., Seattle, Wash.
ANALYSIS FOR STRESSES AND BUCKLING OF HEATED COMPOSITE STIFFENED PANELS AND OTHER STRUCTURES, PHASE 3
A. V. Viswanathan and M. Tamekuni Mar. 1973 83 p refs
(Contract NAS1-8858)
(NASA-CR-112227) Avail: NTIS HC $6.25 CSCL 20K

Analytical methods based on linear theory are presented for predicting the thermal stresses in and the buckling of heated structures with arbitrary uniform cross section. The structure is idealized as an assemblage of laminated plate-strip elements, curved and planar, and beam elements. Uniaxially stiffened plates and shells of arbitrary cross section are typical examples. For the buckling analysis the structure or selected elements may be subjected to mechanical loads, in additional to thermal loads, in any desired combination of inplane transverse load and axial compression load. The analysis is also applicable to stiffened structures under inplane loads varying through the cross section, as in stiffened shells under bending. The buckling analysis is general and covers all modes of instability. The analysis has been applied to a limited number of problems and the results are presented. These while showing the validity and the applicability of the method do not reflect its full capability.
Author

N73-24895*# Boeing Commercial Airplane Co., Seattle, Wash.
BUCLASP 3: A COMPUTER PROGRAM FOR STRESSES AND BUCKLING OF HEATED COMPOSITE STIFFENED PANELS AND OTHER STRUCTURES, USER'S MANUAL
L. L. Tripp, M. Tamekuni, and A. V. Viswanathan Mar. 1973 221 p refs
(Contract NAS1-8858)
(NASA-CR-112228) Avail: NTIS HC $13.25 CSCL 20K

The use of the computer program BUCLASP3 is described. The code is intended for thermal stress and instability analyses of structures such as unidirectionally stiffened panels. There are two types of instability analyses that can be effected by PAINT; (1) thermal buckling, and (2) buckling due to a specified inplane biaxial loading. Any structure that has a constant cross section in one direction, that may be idealized as an assemblage of beam elements and laminated flat and curved plate strip-elements can be analyzed. The two parallel ends of the panel must be simply supported, whereas arbitrary elastic boundary conditions may be imposed along any one or both external longitudinal side. Any variation in the temperature rise (from ambient) through the cross section of a panel is considered in the analyses but it must be assumed that in the longitudinal direction the temperature field is constant. Load distributions for the externally applied inplane biaxial loads are similar in nature to the permissible temperature field.
Author

N73-24896*# Solar, San Diego, Calif.
DEVELOPMENT OF BERYLLIUM HONEYCOMB SANDWICH COMPOSITE FOR STRUCTURAL AND OTHER RELATED APPLICATIONS Final Report, 1 Jul. 1967 - 27 Feb. 1972
J. W. Vogan and L. A. Grant 27 Feb. 1972 133 p
(Contract NAS8-21215)
(NASA-CR-130648; RDR-1550-12) Avail: NTIS HC $8.75 CSCL 13M

The feasibility of fabricating large beryllium honeycomb panels was demonstrated. Both flat and curved sandwich structures were manufactured using practical, braze bonding techniques. The processes developed prove that metallurgically assembled beryllium honeycomb panels show decided potential where rigid, lightweight structures are required. Three panels, each 10 square feet in surface area, were fabricated, and radiographically inspected to determine integrity. This examination revealed a 97 percent braze in the final panel. It is believed that ceramic dies for forming and brazing would facilitate the fabrication techniques for higher production rates. Ceramic dies would yield a lower thermal gradient in the panel during the braze cycle. This would eliminate the small amount of face sheet wrinkling present in the panels. Hot forming the various panel components demonstrated efficient manufacturing techniques for scaling up and producing large numbers of hot formed beryllium components and panels. The beryllium honeycomb panel demonstrated very good vibrational loading characteristics under test with desirable damping characteristics.
Author

N73-24897*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NONLINEAR EQUATIONS FOR BENDING OF ROTATING BEAMS WITH APPLICATION TO LINEAR FLAP-LAG STABILITY OF HINGELESS ROTORS
Dewey H. Hodges and Robert A. Ormiston Washington May 1973 36 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-2770; A-4629) Avail: NTIS HC $3.00 CSCL 20K

The nonlinear partial differential equations for the flapping and lead-lag degrees of freedom of a torisonally rigid, rotating cantilevered beam are derived. These equations are linearized about an equilibrium condition to study the flap-lag stability characteristics of hingeless helicopter rotor blades with zero twist and uniform mass and stiffness in the hovering flight condition. The results indicate that these configurations are stable because the effect of elastic coupling more than compensates for the destabilizing flap-lag Coriolis and aerodynamic coupling. The effect of higher bending modes on the lead-lag damping was found to be small and the common, centrally hinged, spring restrained, rigid blade approximation for elastic rotor blades was shown to be reasonably satisfactory for determining flap-lag stability. The effect of pre-cone was generally stabilizing and the effects of rotary inertia were negligible.
Author

N73-24898# Lockheed Missiles and Space Co., Palo Alto, Calif.
TRIANGULAR ELEMENT TO COMPUTE PLATE VIBRATIONS
V. P. Kandidov and S. S. Chesnokov [1973] 3 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Fiz. Astron. (Moscow), no. 5, 1972 p 624-626
Avail: NTIS HC $3.00; National Translation Center, John Crerar Library, Chicago, Ill. 60616

The application of finite elements of triangular shape for computing plate vibrations is discussed. An element in the form of a right triangle with four degrees of freedom is proposed. It is stated that the orientation of the triangle will not influence the results of the computation since two such elements, rotated 180 degrees, will form a rectangular element upon being jointed. Mathematical matrices are developed to substantiate the theoretical concepts.
Author

N73-24899# Lockheed Missiles and Space Co., Palo Alto, Calif.
ANALYSIS OF THE STABILITY OF RECTANGULAR PLATES IN AN AIR STREAM BY THE METHOD OF FINITE ELE-

MENTS
V. P. Kandidov and S. S. Chesnokov [1973] 8 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Fiz. Astron. (Moscow), v. 12, no. 5, 1972 p 495-502
Avail: NTIS HC $3.00; National Translation Center, John Crerar Library, Chicago, Ill. 60616

The finite element method is applied to analyze the static strains and free vibrations of plate dynamics in a supersonic stream. The behavior of rectangular cantilever plates of different span in the stream examined. Application of the finite element method to the solution of nonconservative problems of elastic stability is considered. Mathematical models are developed to clarify the theoretical aspects. Author

N73-24900*# Toledo Univ., Ohio.
PLANE ELASTO-PLASTIC ANALYSIS OF V-NOTCHED PLATE UNDER BENDING BY BOUNDARY INTEGRAL EQUATION METHOD Ph.D. Thesis
Walter Rzasnicki Mar. 1973 330 p refs Sponsored by NASA
(NASA-CR-132225) Avail: NTIS HC $18.50 CSCL 20K

A method of solution is presented, which, when applied to the elasto-plastic analysis of plates having a v-notch on one edge and subjected to pure bending, will produce stress and strain fields in much greater detail than presently available. Application of the boundary integral equation method results in two coupled Fredholm-type integral equations, subject to prescribed boundary conditions. These equations are replaced by a system of simultaneous algebraic equations and solved by a successive approximation method employing Prandtl-Reuss incremental plasticity relations. The method is first applied to a number of elasto-static problems and the results compared with available solutions. Good agreement is obtained in all cases. The elasto-plastic analysis provides detailed stress and strain distributions for several cases of plates with various notch angles and notch depths. A strain hardening material is assumed and both plane strain and plane stress conditions are considered.
Author

N73-24901*# General Dynamics/Electronics, San Diego, Calif. Research and Engineering Dept.
DETECTION OF FATIGUE CRACKS BY NONDESTRUCTIVE TESTING METHODS Final Report
R. T. Anderson, T. J. DeLacy, and R. C. Stewart Mar. 1973 94 p refs
(Contract NAS9-12326)
(NASA-CR-128946; GDCA-DBG73-002) Avail: NTIS HC $6.75 CSCL 20K

The effectiveness was assessed of various NDT methods to detect small tight cracks by randomly introducing fatigue cracks into aluminum sheets. The study included optimizing NDT methods calibrating NDT equipment with fatigue cracked standards, and evaluating a number of cracked specimens by the optimized NDT methods. The evaluations were conducted by highly trained personnel, provided with detailed procedures, in order to minimize the effects of human variability. These personnel performed the NDT on the test specimens without knowledge of the flaw locations and reported on the flaws detected. The performance of these tests was measured by comparing the flaws detected against the flaws present. The principal NDT methods utilized were radiographic, ultrasonic, penetrant, and eddy current. Holographic interferometry, acoustic emission monitoring, and replication methods were also applied on a reduced number of specimens. Generally, the best performance was shown by eddy current, ultrasonic, penetrant and holographic tests. Etching provided no measurable improvement, while proof loading improved flaw detectability. Data are shown that quantify the performances of the NDT methods applied. Author

N73-24902*# Texas A&M Univ., College Station. Aerospace Engineering Dept.
LARGE DEFLECTION ELASTIC-PLASTIC DYNAMIC RESPONSE OF STIFFENED SHELLS OF REVOLUTION
James A. Stricklin, Walter E. Haisler, Walter A. VonRiesemann (Sandia Labs.), Roger D. Leick, Barry Hunsaker, and Kenneth J. Saczalski (ONR) Dec. 1972 113 p refs Sponsored by AEC
(Grant NGL-44-001-044; Contract N00011-68-A-0308-0004)
(NASA-CR-132044; SLA-73-0128; TEES-RPT-72-25) Avail: NTIS HC $7.75 CSCL 20K

The formulation and check out problems for a computer code DYNAPLAS, which analyzes the large deflection elastic-plastic dynamic response of stiffened shells of revolution, are presented. The formulation for special discretization is by the finite element method with finite differences being used for the evaluation of the pseudo forces due to material and geometric nonlinearities. Time integration is by the Houbolt method. The stiffeners may be due to concentrated or distributed eccentric rings and spring supports at arbitrary angles around the circumference of the elements. Check out problems include the comparison of solutions from DYNAPLAS with experimental and other computer solutions for rings, conical and cylindrical shells and a curved panel. A hypothetical submarine including stiffeners and missile tube is studied under a combination of hydrostatic and dynamically applied asymmetrical pressure loadings. Author

N73-24903*# Goodyear Aerospace Corp., Akron, Ohio.
COMPUTER PROGRAM FOR THE LOAD AND TRAJECTORY ANALYSIS OF TWO DOF BODIES CONNECTED BY AN ELASTIC TETHER: USERS MANUAL
George R. Doyle, Jr. and James W. Burbick 5 Feb. 1973 99 p refs
(Contract NAS8-29144)
(NASA-CR-124259; Ger-15853) Avail: NTIS HC $7.00 CSCL 20K

The derivation of the differential equations of motion of a 3 Degrees of Freedom body joined to a 3 Degrees of Freedom body by an elastic tether. The tether is represented by a spring and dashpot in parallel. A computer program which integrates the equations of motion is also described. Although the derivation of the equations of motions are for a general system, the computer program is written for defining loads in large boosters recovered by parachutes. Author

N73-24904*# California Univ., Los Angeles. Dept. of Mechanics and Structures.
MODAL ANALYSIS FOR LIAPUNOV STABILITY OF ROTATING ELASTIC BODIES Ph.D. Thesis. Final Report
Andre Daniel Colin Apr. 1973 220 p refs
(Contract NAS8-28358)
(NASA-CR-124258; UCLA-ENG-7329) Avail: NTIS HC $13.00 CSCL 20K

This study consisted of four parallel efforts: (1) modal analyses of elastic continua for Liapunov stability analysis of flexible spacecraft; (2) development of general purpose simulation equations for arbitrary spacecraft; (3) evaluation of alternative mathematical models for elastic components of spacecraft; and (4) examination of the influence of vehicle flexibility on spacecraft attitude control system performance. A complete record is given of achievements under tasks (1) and (3), in the form of technical appendices, and a summary description of progress under tasks two and four. Author

N73-24905# Sandia Labs., Livermore, Calif.
SHEAR WAVES IN LAYERED COMPOSITES
C. W. Robinson Dec. 1972 108 p refs
(Contract AT(29-1)-789)
(SCL-RR-72-0351) Avail: NTIS

Beginning from the theory of elasticity, the propagation of shear waves in a layered composite is analyzed. The analogy between such a composite and a crystal lattice is developed, allowing interpretation of the problem in terms of lattice theory and allowing adoption of many concepts and results from solid state physics. Methods for the solution of boundary value problems are derived, and a computer program to evaluate the functions and provide graphical representations of the solutions is described. Interferometric ultrasonic experiments were performed on a layered steel/copper composite. For waves propagating normal to the layers, the existence of allowed propagation frequencies (bands) and forbidden frequencies (gaps) was observed for three bands and two gaps. For waves propagating obliquely the existence of diffracted waves was observed. The resulting experimental dispersion relations fit the theory to a high degree of precision.
Author

N73-24906# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
CALCULATIONS OF THE STRESS AND STRAIN IN TWO

FOLD CONTINUOUS PRISMATIC BODIES WITH EXAMPLE OF CALCULATION FOR A RIBBED FUEL TUBE
R. Kreig Oct. 1972 142 p refs In GERMAN; ENGLISH summary
(KFK-1665) Avail: AEC Depository Libraries

The stress distribution of classic prismatic bodies with uniform loads along their axis is described by a partial differential equation. An incremental procedure is employed, so that for each small time step an elastic stress distribution as well as corresponding increments of creep strains can be calculated. The initial strains for an elastic stress solution at a certain time are represented by the creep strains accumulated up to this time. Applying the described theory two computer programs were developed: EVA1 (linear elastic material) and EVA2 (nonlinear material). Both programs are particularly suited for the stress analysis of nuclear reactor fuel pins with integrated axial ribs. Various case studies are included showing the effects of internal pressure, thermal strains, swelling as well as irradiation induced creep.
Author (NSA)

N73-24907# Ecole Nationale Superieure des Mines, Paris (France). Centre des Materiaux.
THEORETICAL AND EXPERIMENTAL STUDY OF THE ELASTIC STABILITY OF BEAMS AND PLATES OF COMPOSITE MATERIAL. PART 4: EXPERIMENTAL RESULTS OBTAINED ON PLATES, AND DISCUSSIONS ON MEASUREMENT METHODS [ETUDE THEORIQUE ET EXPERIMENTALE DE LA STABILITE ELASTIQUE DE POUTRES ET PLAQUES EN MATERIAUX COMPOSITES. PARTIE 4: RESULTATS EXPERIMENTAUX OBTENUS SUR LES PLAQUES, ET DISCUSSION DES METHODES DE MESURE]
A. Chailleux and Y. Hans Oct. 1972 87 p refs In FRENCH Prepared jointly with Ecole Natl. Super. de Tech. Avancees
(ENSMP-007) Avail: NTIS HC $6.50

An experimental study on the buckling of rectangular boron reinforced aluminum plates loaded in their plane has been carried out. Two methods of measuring the critical load were described: a static method, making use of the Southwell graph and a dynamic method measuring the evolution of the transverse vibration natural frequency. Precautions to be taken in order to obtain significant results are discussed. It has been shown that the reliability of both methods depends only on the imperfections of the plate under test. ESRO

N73-24908# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
AN ASYMPTOTIC FINITE-DEFORMATION ANALYSIS OF THE ELASTOSTATIC FIELD NEAR THE TIP OF A CRACK
James K. Knowles and Eli Sternberg Jan. 1973 82 p refs
(Contract N00014-67-A-0094-0020; NR Proj. 064-031)
(AD-757777; TR-27) Avail: NTIS CSCL 20/11

The paper contains an asymptotic treatment, consistent with the fully nonlinear equilibrium theory of compressible elastic solids, of the stresses and deformations near the tip of a traction-free crack in a slab of all-around infinite extent under conditions of plane strain. The loading applied at infinity is taken to be one of uniform uni-axial tension at right angles to the faces of the crack. For the particular class of elastic materials considered the tensile stress in large homogeneous uni-axial extension is asymptotic to a continuously adjustable power of the corresponding principal stretch. The asymptotic analysis of the foregoing crack problem is reduced to a nonlinear eigenvalue problem, the solution of which is established in closed form, in terms of elementary functions and certain transcendental integrals of such functions. (Author Modified Abstract) GRA

N73-24909# Naval Intelligence Support Center, Washington, D.C. Translation Div.
EXPERIMENTAL INVESTIGATION OF THE STABILITY OF CYLINDRICAL SHELLS WITH CONSIDERATION OF INITIAL IMPERFECTIONS
V. M. Kots and D. E. Lipovskii 2 Feb. 1973 15 p refs Transl. into ENGLISH from Tr., 6th Vsesoyuznaya Konf. po Teorii Plastin i Obolochek (USSR) 1966
(AD-757728; NISC-Trans-3394) Avail: NTIS CSCL 20/11

The experimental dependence of critical stresses on the measured parameters of the initial bending and configuration of shells is investigated, and the dynamics of the process of wave formation during buckling is studied. The coefficients of critical stresses, obtained from the experiment, are compared with theoretical values. GRA

N73-24910# Naval Intelligence Support Center, Washington, D.C.
THE EFFECT OF THE NONHOMOGENEITY OF THE STRESS STATE AND INITIAL IMPERFECTIONS ON THE STABILITY OF CYLINDRICAL SHELLS
V. I. Mossakovskii 21 Feb. 1973 20 p refs Transl. into ENGLISH from Tr. Vsesoyuznaya Konf. po Teorii Plastin i Obolochek (6th) (USSR), 1966
(AD-758027; NISC-Trans-3404) Avail: NTIS CSCL 20/11

The problems considered in the report involve the calculation of the minimum eigenvalue of a system of linear differential equations with variable coefficients. Precise solution of this problem is impossible in most cases; therefore, different approximation methods are commonly used, which usually reduce the initial problem to calculation of the minimum eigenvalue of an infinite matrix. GRA

N73-24911# Naval Intelligence Support Center, Washington, D.C. Translation Div.
THE DEVELOPMENT OF APPLIED METHODS IN PROBLEMS OF STATIC CALCULATION OF THIN-WALLED THREE-DIMENSIONAL SYSTEMS (SHELLS AND FOLDS)
I. E. Mileikovskii and V. D. Raizer 21 Feb. 1973 26 p refs Transl. into ENGLISH from Tr., 6th Vsesoyuznaya Konf. po Teorii Plastin i Oboloch (USSR) 1966
(AD-758028; NISC-Trans-3405) Avail: NTIS CSCL 20/11

The report reviews recent mathematical methods used to calculate the strength of thin-walled elastic systems. Included are the following: Variational and variational-difference methods; The finite element method; Method of calculating operators and input equations; The method of initial functions; Methods of calculating thin-walled systems using partial solutions of homogeneous solving equations of the two-dimensional problem and banding of plates; The small parameter method. GRA

N73-24912# Naval Intelligence Support Center, Washington, D.C. Translation Div.
ON THE EFFECT OF THE ARRANGEMENT OF STIFFENING RIBS FOR A CYLINDRICAL SHELL ON THE VALUE OF CRITICAL LOAD
O. I. Terebushko 21 Feb. 1973 17 p refs Transl. into ENGLISH from Tr., 6th Vsesoyuznaya Konf. po Teorii Plastin i Oboloch (USSR) 1966
(AD-758029; NISC-Trans-3406) Avail: NTIS CSCL 20/11

The arrangement of ribs both with respect to the median surface (inner or outer) and with respect to the lines of principal curvature has an appreciable effect on the value of critical load of a stiffened shell. The effect of internal or external arrangement of ribs with respect to the median surface on the value of the critical load of a stiffened shell is considered. GRA

N73-24913# Naval Intelligence Support Center, Washington, D.C. Translation Div.
STATISTICAL ANALYSIS OF THE STABILITY OF IMPERFECT CYLINDRICAL SHELLS
B. N. Markarov 21 Feb. 1973 12 p refs Transl. into ENGLISH from Tr., 6th Vsesoyuznaya Konf. po Teorii Plastin i Oboloch (USSR) 1966
(AD-758030; NISC-Trans-3407) Avail: NTIS CSCL 20/11

The problem of the stability of a thin cylindrical shell whose median surface has random initial deviations from ideal shape is considered. An attempt is made to construct a solution of the stochastic problem of the stability of a cylindrical shell with an arbitrary calculated number of random parameters, characterizing the deviations of the median surface from ideal shape. The coefficients of a double Fourier series are selected as these parameters, with the aid of which the function of initial imperfections is represented. GRA

N73-24914# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE STABILITY OF FLEXIBLE FLAT SHELLS RECTANGULAR IN THE PLAN

M. A. Koltunov 16 Mar. 1973 40 p refs Transl. into ENGLISH from Issled po Teorii Plastin i Obolochek (Kazan), no. 7, 1970 p 679-707
(AD-758327; FTD-MT-24-1516-72) Avail: NTIS CSCL 20/11

Bending and stability equations are provided for flexible orthotropic plates and gently sloping cylindrical shells, the material of which possess the properties of linear heredity. Author

N73-24915# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
SOME REMARKS ON THE STRAIN RATE SENSITIVE BEHAVIOR OF SHELLS
Norman Jones May 1972 11 p refs
(Contract N00014-67-A-0204-0032)
(AD-758074; Rept-72-6) Avail: NTIS CSCL 13/13

An experimental investigation into the dynamic plastic behavior of various shells has been reported recently in other reports. The inner surfaces of the test models were subjected to uniformly distributed impulsive velocities which produced extensive plastic deformation. The present report describes the viscoplastic characteristics of some of these models. GRA

N73-24916# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
ELASTIC STRESSES DUE TO AXIAL LOADS ON A NOZZLE WHICH INTERSECTS A CYLINDRICAL SHELL
J. W. Hansberry and Norman Jones Oct. 1972 67 p refs
(Contract N00014-67-A-0204-0032)
(AD-758075; Rept-72-20) Avail: NTIS CSCL 13/13

A collocation method was developed in order to describe the elastic behavior of two normally intersecting cylindrical shells. The intersecting shell (nozzle) was subjected to an axial load and the intersected shell (vessel) was simply supported at both ends. It was observed that the numerical procedure predicted stress distributions which exhibited encouraging agreement with the corresponding experimental tests of Cranch and Dally on shell intersections with small radius ratios. Author (GRA)

N73-24917# California Univ., Berkeley. Dept. of Mechanical Engineering.
ON THE GENERAL THEORY OF STABILITY FOR ELASTIC BODIES
P. M. Naghdi and J. A. Trapp Feb. 1973 58 p refs
(Contract N00014-69-A-0200-1008; NR Proj. 064-436)
(AD-757856; AM-73-1) Avail: NTIS CSCL 20/11

The paper deals with the stability of loaded equilibrium configuration of elastic bodies, within the framework of nonlinear thermoelasticity. Although most of the results are obtained in the context of thermo-mechanical stability, the parallel developments for the purely mechanical stability are also considered. Using an appropriate thermodynamic restriction, several theorems are proved concerning a sufficient condition for stability of the equilibrium configuration. These theorems hold under a general class of motions and their validity is not limited to small motions and small temperature changes from a loaded equilibrium state. Various generalizations of the main results are discussed and the reasonableness of the proposed stability criterion is demonstrated. Author (GRA)

N73-24918# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DISCONTINUOUS FUNCTIONS IN PROBLEMS OF STRENGTH AND STABILITY OF ELONGATED CYLINDRICAL PANELS WITH FINITE DEFLECTIONS
A. S. Efimov 26 Mar. 1973 30 p refs Transl. into ENGLISH from Issled. po Teori i Plastin i Obolochek (Kazan), no. 7, 1970 p 368-386
(AD-758621; FTD-MT-24-1518-72) Avail: NTIS CSCL 20/11

Different local properties of a curved element and external actions are interpreted with the aid of discontinuous functions. The general method for determining the boundaries of actually existing forms of the loss of stability is given along with the results of optimum design during calculations of the stability of a flexible gently sloping cylindrical panel. Author

N73-24919# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
SOME APPLICATIONS OF THE PRINCIPLE OF VIRTUAL WORK
Philip G. Hodge, Jr. Mar. 1973 41 p refs
(Contract N00014-67-A-0113-0025; NR Proj. 064-429)
(AD-758727; AEM-H1-5) Avail: NTIS CSCL 20/11

The Principle of Virtual Work is reviewed in its relation to continuum mechanics. A formal three-dimensional proof is given for reference, and the principle is also stated in terms of generalized variables. Applications are given for general theorems such as uniqueness for specific media, for derivation of structural theories independently of material characteristics, and to numerical methods of finite element analysis. Author (GRA)

N73-24920# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
COMPLETE SOLUTIONS FOR ELASTIC-PLASTIC TRUSSES
Philip G. Hodge, jr. Mar. 1973 34 p refs
(Contract N00014-67-A-0113-0025; NR Proj. 064-428)
(AD-758726; AEM-H1-4) Avail: NTIS CSCL 20/11

The complete solution for stresses and displacements of an elastic truss may be found by direct solution of the defining equations or by using either of the elastic minimum principles. From both a theoretical and computational approach, the three methods are very similar. Three related methods are available for elastic/perfectly-plastic trusses, but here they are quite distinct. It is shown that none of the three is entirely satisfactory, but that a combined method leads directly to a complete solution. In the proposed method, the static minimum principle is first used to find the stress rates and stresses, and some information from the stress solution is fed into the kinematic minimum principle to obtain the velocities and displacements. Author (GRA)

N73-24014 Cambridge Univ. (England). Engineering Lab.
THE ANALYSIS OF BLADE VIBRATION DUE TO RANDOM EXCITATION
D. S. Whitehead *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 833-848 refs Previously issued as ARC-22119 (For availability see N73-24011 15-01)
(ARC-R/M-3253; ARC-22119)

N73-24015 Cambridge Univ. (England). Dept. of Engineering.
FORCE AND MOMENT COEFFICIENTS FOR VIBRATING AEROFOILS IN CASCADE
D. S. Whitehead *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 849-885 refs Previously issued as ARC-22133 (For availability see N73-24011 15-01)
(ARC-R/M-3254; ARC-22133)

N73-24017 Ministry of Aviation, London (England).
BEHAVIOUR OF SKIN FATIGUE CRACKS AT THE CORNERS OF WINDOWS IN A COMET 1 FUSELAGE
R. J. Atkinson, W. J. Winkworth, and G. M. Norris *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 929-963 refs Previously issued as RAE-R-STRUCT-257; ARC-22270 (For availability see N73-24011 15-01)
(ARC-R/M-3248; RAE-STRUCT-257; ARC-22270)

N73-24029 Aeronautical Research Council, London (England).
THE DESIGN OF MICHELL OPTIMUM STRUCTURES
In its Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1437-1476 refs Previously issued as Rept-142; ARC-22596 (For availability see N73-24011 15-01)
(ARC-R/M-3303; Rept-142; ARC-22596)

N73-24031 Aeronautical Research Council, London (England).
THERMAL BUCKLING OF CIRCULAR PLATES
B. Cotterell and E. W. Parkes *In its* Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1495-1507 Previously issued as ARC-22246 (For availability see N73-24011 15-01)
(ARC-R/M-3245; ARC-22246)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N73-24921+National Lending Library for Science and Technology, Boston Spa (England).
THE USE OF HEAT PUMPS FOR HEAT RECOVERY
G. Trenkowitz 12 Mar. 1973 22 p refs Transl. into ENGLISH from Electrowaerme Intern. (West Germany), v. 30, no. 4, Jul. 1972 p A180-A187
(NLL-OA-Trans-1264-(6196.3)) Avail: NTIS Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The use of heat pumps for heat recovery is discussed. Three specific applications are suggested as follows: (1) adjusting heat balance in large factories, (2) heat recovery from exhaust air of air conditioned buildings, and (3) exploitation of condensed heat from refrigeration plants. The combining of the normal heat pump heating with air, water or the earth as a heat source is proposed. Author

N73-24922 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF PERIODIC FLUCTUATIONS ON THE STRUCTURE AND THE PROPAGATION OF A COMBUSTION ZONE
J. C. Leyer [1973] 29 p refs Transl. into ENGLISH from Rev. Gen. Therm. (Paris), v. 69, 1967 p 1157-1169
(NLL-M-22985-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The conditions in which a coupling is possible between the structure of a combustion front and the periodic oscillations are analyzed. The investigation was conducted using a furnace supplied with a gaseous mixture and arranged in such a manner that the combustion front, in the absence of oscillations would be laminar and stable. Periodic speed and pressure oscillations acting transverse to the general direction of gas flow created the instability of the flame front. Author

N73-24923 Rensselaer Polytechnic Inst., Troy, N.Y.
AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF SUCTION BOILING Ph.D. Thesis
Richard Jon Raiff 1972 188 p
Avail: Univ. Microfilms Order No. 72-30229

A theoretical and experimental investigation of steady state heat and mass transfer in suction boiling was performed. Suction boiling is a process in which the flow of an evaporating fluid and its vapor is controlled by a microporous flow control element. The theory describes the heat and mass transfer process by use of a set of second order partial differential equations and appropriate boundary conditions. The solutions are presented in three groups corresponding to the three modes of operation is suction boiling. These are: (1) Suction nucleate boiling in which the liquid-vapor interface at the down stream surface of the flow control element. (2) Departure from suction nucleate boiling. (3) Suction film boiling in which the liquid-vapor interface is at a phase within the flow control element. Examination of the parameters involved in the suction nucleate boiling process indicated that it could be developed into a significant heat exchanger process. The experimental configuration represents such a possible heat exchanger design. Dissert. Abstr.

N73-24924# National Aerospace Lab., Tokyo (Japan).
A CALCULATION OF TEMPERATURE DISTRIBUTION BY APPLYING GREEN'S FUNCTION TO A TWO DIMENSIONAL LAPLACE'S EQUATION: THE CASE IN WHICH THE TEMPERATURE GRADIENTS ON THE BOUNDARY ARE GIVEN
Hideaki Nishimura and Hiroshi Usui 1972 29 p refs In JAPANESE; ENGLISH summary
(NAL-TR-297) Avail: NTIS HC $3.50

The research on an air-cooled turbine blade surrounded by a high-temperature gas stream is reported. The prevention of the blade from destruction by thermal stress, thermal shock and fatigue, etc. was studied. A case where a temperature-gradient distribution is given on the blade boundary is treated as the second boundary-value problem (Neuman Problem), assuming that: (1) the temperature field is bounded by smooth lines forming arbitrary figures; (2) steady state; (3) two-dimensional; (4) without heat source and heat sink; (5) and the material is isotropic. An example of the temperature distribution and the isothermal lines, obtained from this method, in a blade with eleven air-cooled holes is presented. Author

N73-24925*# Martin Marietta Corp., Denver, Colo.
INTERNAL INSULATION SYSTEM DEVELOPMENT Final Report
John P. Gille May 1973 144 p refs
(Contract NAS3-14384)
(NASA-CR-121102; MCR-72-274) Avail: NTIS HC $9.25 CSCL 20M

The development of an internal insulation system for cryogenic liquids is described. The insulation system is based on a gas layer concept in which capillary or surface tension effects are used to maintain a stable gas layer within a cellular core structure between the tank wall and the contained cryogen. In this work, a 1.8 meter diameter tank was insulated and tested with liquid hydrogen. Ability to withstand cycling of the aluminum tank wall to 450 K was a design and test condition. Author

N73-24926*# National Bureau of Standards, Washington, D.C. Fire Technology Div.
FIRE EXTINGUISHMENT IN OXYGEN ENRICHED ATMOSPHERES
A. F. Robertson and M. W. Rappaport Feb. 1973 63 p refs
(NASA Order C-506273)
(NASA-CR-121150) Avail: NTIS HC $5.25 CSCL 20M

Current state-of-the-art of fire suppression and extinguishment techniques in oxygen enriched atmosphere is reviewed. Four classes of extinguishment action are considered: cooling, separation of reactants, dilution or removal of fuel, and use of chemically reactive agents. Current practice seems to show preference for very fast acting water spray applications to all interior surfaces of earth-based chambers. In space, reliance has been placed on fire prevention methods through the removal of ignition sources and use of nonflammable materials. Recommendations are made for further work related to fire suppression and extinguishment in oxygen enriched atmospheres, and an extensive bibliography is appended. Author

N73-24927*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPINGEMENT HEAT TRANSFER FROM TURBULENT AIR JETS TO FLAT PLATES: A LITERATURE SURVEY
John N. B. Livingood and Peter Hrycak (Newark Coll. of Engr.) Washington May 1973 44 p refs
(NASA-TM-X-2778; E-7298) Avail: NTIS HC $3.00 CSCL 20M

Heat transfer characteristics of single and multiple turbulent air jets impinging on flat surfaces have been studied by many investigators. Results of many of these studies are summarized. Suggested correlations for use in the design of cooled turbine blades are noted, and areas where further research would be advisable are identified. Author

N73-24928*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVED MULTIPLE-SHOT GUN FOR USE AS A COMBUSTION STABILITY RATING DEVICE
Daniel E. Sokolowski Washington May 1973 30 p refs
(NASA-TM-X-2792; E-7287) Avail: NTIS HC $3.00 CSCL 20M

A program was conducted to develop and experimentally evaluate an improved version of a modified machine gun for use as a device for rating the relative combustion stability of various rocket combustors. Following the results of a previous study involving a caliber .30 machine gun, a caliber .50 machine gun was modified in order to extend the charge-size range of the device. Nitrocellulose charge sizes ranging from 1.004 to 9.720 grams were fired at rates up to four shots per second. Shock pressures up to 25,512 kN/sq m were measured near the end of a shortened gun barrel. A minimal resistance type of

check valve permitted the gun to fire into pressurized regions; back pressures up to 3448 kN/sq m abs were tested. The final modified assembly was evaluated during combustion stability tests on rocket combustors burning a FLOX-methane propellant combination. Author

N73-24929*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENGINE INVESTIGATION OF AN IMPINGEMENT-COOLED TURBINE ROTOR BLADE
James W. Gauntner and John N. B. Livingood Washington May 1973 23 p refs
(NASA-TM-X-2791; E-7313) Avail: NTIS HC $3.00 CSCL 20M

Experimentally determined heat transfer characteristics of an impingement-cooled turbine rotor blade are reported. The test results are compared with those obtained for three convection-cooled turbine blades tested in the same facility in addition to impingement correlations found in literature. Author

N73-24930*# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
FURTHER CHARACTERIZATION OF CLOSED PORE INSULATION (CPI) Final Report
Michael Russak and Carl Feldman May 1973 50 p refs
(Contract NAS1-10713)
(NASA-CR-112295; RE-455) Avail: NTIS HC $4.50 CSCL 20M

The thermophysical and mechanical properties of closed pore insulation (CPI) were measured after exposure to 25 simulated reentry thermal cycles. In addition, mechanical properties were obtained at elevated temperatures before and after cycling. The properties of CPI were not compromised by the cycling. High temperature creep studies were done on three CPI compositions (4, 8, and 12 Wt% CoO additive). CPI-4 had the best creep resistance at temperatures up to 1363 K. Author

N73-24931*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF PRESSURE ON TANGENTIAL-INJECTION FILM COOLING IN A COMBUSTOR EXHAUST STREAM
Cecil J. Marek Washington Jun. 1973 15 p refs
(NASA-TM-X-2809; E-7388) Avail: NTIS HC $3.00 CSCL 20M

A tangential-injection film cooled test section was placed in the exhaust stream of a high pressure combustor. Film cooling data were taken at pressure of 1, 10, and 20 atmospheres. The film cooling effectiveness was found to be independent of pressure. The data were correlated adequately by a turbulent-mixing film cooling correlation with a turbulent-mixing coefficient of 0.05 + or - 0.02. Author

N73-24932*# City Univ. of New York.
HEAT TRANSFER COEFFICIENTS OF DILUTE FLOWING GAS-SOLIDS SUSPENSIONS
Ronald S. Kane and Robert Pfeffer Washington NASA Jun. 1973 32 p refs
(Grant NGL-33-013-029)
(NASA-CR-2266) Avail: NTIS HC $3.00 CSCL 20M

Heat transfer coefficients of air-glass, argon-glass, and argon-aluminum suspensions were measured in horizontal and vertical tubes. The glass, 21.6 and 36.0 micron diameter particles, was suspended at gas Reynolds numbers between 11,000 and 21,000 and loading ratios between 0 and 2.5. The presence of particles generally reduced the heat transfer coefficient. The circulation of aluminum powder in the 0.870 inch diameter closed loop system produced tenacious deposits on protuberances into the stream. In the vertical test section, the Nusselt number reduction was attributed to viscous sublayer thickening; in the horizontal test section to particle deposition. Author

N73-24933*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF FUEL VAPOR CONCENTRATIONS ON COMBUSTOR EMISSIONS AND PERFORMANCE
Carl T. Norgren and Robert D. Ingebo Washington Jun. 1973 35 p refs
(NASA-TM-X-2800; E-7336) Avail: NTIS HC $3.00 CSCL 20M

Effects of fuel vaporization on the exhaust emission levels of oxides of nitrogen, carbon monoxide, total hydrocarbons, and smoke number were obtained in an experimental turbojet combustor segment. Two different fuel injectors were used in which liquid ASTM A-1 jet fuel and vapor propane fuel were independently controlled to simulate varying degrees of vaporization. Tests were conducted over a range of inlet-air temperatures from 478 to 700 K, pressures from 4 to 20 atm, and combustor reference velocities from 15.3 to 27.4 m/sec. Converting from liquid to complete vapor fuel resulted in oxides of nitrogen reductions of as much as 22 percent and smoke number reductions up to 51 percent. Supplement data are also presented on flame emissivity, flame temperature, and primary-zone liner wall temperatures. Author

N73-24934*# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
THE INVESTIGATION OF CRITICAL BURNING OF FUEL DROPLETS Annual Report, 1 Jan. - 31 Dec. 1972
C. B. Allison, G. S. Canada, and G. M. Faeth Jan. 1973 50 p refs
(Grant NGR-39-009-077)
(NASA-CR-121113) Avail: NTIS HC $4.50 CSCL 20M

The combustion and evaporation of liquid fuels at high pressures were investigated. Particular emphasis was placed on conditions where the liquid surface approaches the thermodynamic critical point during combustion. The influence of transient effects on a burning liquid fuel was also investigated through both analysis and measurements of the response of liquid monopropellant combustion to imposed pressure oscillations. Work was divided into four phases (1) Droplet combustion at high pressures, which consider both measurement and analysis of the porous sphere burning rate of liquids in a natural convection environment at elevated pressure. (2) High pressure droplet burning in combustion gases, which involved steady burning and evaporation of liquids from porous spheres in a high pressure environment that simulates actual combustion chamber conditions. (3) Liquid strand combustion, which considered the burning rate, the state of the liquid surface and the liquid phase temperature distribution of a burning liquid monopropellant column over a range of pressures. (4) Oscillatory combustion, which was a theoretical and experimental investigation of the response of a burning liquid monopropellant to pressure oscillations. Author

N73-24935*# Ohio Semitronics, Inc., Columbus.
THERMOELECTRIC THIN FILM THERMAL COATING SYSTEMS Quarterly Progress Report, 1 Jan. - 31 Mar. 1973
J. W. C. Harpster, W. E. Bulman, A. E. Middleton, P. R. Swinehart, and F. D. Braun 15 Apr. 1973 85 p refs
(Contract NAS8-28519)
(NASA-CR-124256; QPR-3) Avail: NTIS HC $6.25 CSCL 20M

Derivation of the fluid loop temperature profile for a model with thermoelectric devices (TED) attached is developed as a function of position, incident radiation intensity, input fluid loop temperature and TED current. The associated temperature of the radiator is also developed so that the temperature difference across the TED can be determined for each position. The temperature difference is used in determining optimum operating conditions and available generated electrical power. Author

N73-24936*# Florida Univ., Gainesville. Dept. of Nuclear Engineering Sciences.
THERMODYNAMIC PROPERTIES OF UF SUB 6 MEASURED WITH A BALLISTIC PISTON COMPRESSOR
David E. Sterritt, George T. Lalos (NOL), and Richard T. Schneider Mar. 1973 79 p refs
(Grant NGL-10-005-089)
(NASA-CR-132051) Avail: NTIS HC $6.00 CSCL 20M

From experiments performed with a ballistic piston compressor, certain thermodynamic properties of uranium hexafluoride were investigated. Difficulties presented by the nonideal processes encountered in ballistic compressors are discussed and a computer code BCCC (Ballistic Compressor Computer Code) is developed to analyze the experimental data. The BCCC unfolds the thermodynamic properties of uranium hexafluoride from the helium-uranium hexafluoride mixture used as the test gas in the

ballistic compressor. The thermodynamic properties deduced include the specific heat at constant volume, the ratio of specific heats for UF6, and the viscous coupling constant of helium-uranium hexafluoride mixtures. Author

N73-24937# Aktiebolaget Atomenergi, Studsvik (Sweden).
TEMPERATURE INCREMENTS FROM DEPOSITS ON HEAT TRANSFER SURFACES: THE THERMAL RESISTIVITY AND THERMAL CONDUCTIVITY OF DEPOSITS OF MAGNETITE, CALCIUM HYDROXY APATITE, HUMUS, AND COPPER OXIDES
T. Kelen and J. Arvesen 1972 69 p refs
(AE-459) Avail: AEC Depository Libraries

The temperature rise at heat transfer surfaces produced by deposits of magnetite, humus calcium hydroxy apatite and copper oxides was studied. The investigation was carried out in high pressure equipment at 70 bar and 285 C under boiling conditions. Deposits were formed on a heated test surface. The thermal properties were then evaluated from determinations of temperature rise, thickness of deposit, mass of deposit per unit area and density of heat flow rate. Diagrams are presented in which the temperature rise from a deposit can be estimated when the density of heat flow rate and the thickness or the mass per unit area are known. Author (NSA)

N73-24938# National Physical Lab., Teddington (England). Div. of Chemical Standards.
THE THERMODYNAMIC PROPERTIES OF SILICATES
P. J. Spencer Feb. 1973 39 p refs
(NPL-Chem-21) Avail: NTIS HC $4.00

A critical assessment of tabulated data for solid silicates including glasses is presented. Data on molten binary, ternary, and quaternary silicate systems is discussed. ESRO

N73-24939# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PHYSICO-CHEMICAL SURFACE PHENOMENA IN REINFORCED PLASTICS ABLATION
Jean Brulard, Jean Crabol, Guy Lengelle, and Claude Verdier Sep. 1972 78 p refs In FRENCH; ENGLISH summary
(ONERA-NT-195) Avail: NTIS HC $6.00

In order to establish a computer program for the evaluation of speed of ablation and heat shielding of surface materials during atmospheric reentry, precise experimental data are required to justify the assumptions utilized. Three methods of investigation are presented: (1) dynamic visualization through high-speed motion pictures using orthostralon, orthostrasil, and silica samples in air and nitrogen flow; (2) analysis of gases samples at the boundary layer; and (3) measurement of surface temperature by micropyrolysis. It is concluded that, in the range of experimental conditions used, the boundary layer and the surface react chemically. The principles of a mathematical model for the chemically reacting boundary layer on an ablating body are presented. ESRO

N73-24940# IIT Research Inst., Chicago, Ill. Engineering Mechanics Div.
LAUNCHER IMPROVEMENT FOR ILLUMINATION SYSTEM FLARE, SURFACE: PARACHUTE XM 183 Final Report, 28 Apr. 1971 - 28 Jan. 1972
Daniel J. Herkes Dec. 1972 25 p
(Contract DAAD05-71-C-0315)
(AD-757731; LWL-CR-09F70) Avail: NTIS CSCL 19/6

The objective of this nine-month program was to improve the present feasibility model launcher for mass production. In addition, design features such as flare package retention and positive locking were to be investigated. To assure system reliability, a method of verifying these objectives was required. During the course of this program, a development approach and test plan was generated and approved for engineering activities. A verification test fixture was designed and constructed to simulate impact type loading on a launcher. Experimental and production type launcher systems can be subjected to peak recoil conditions of 1600 lb for 5 msec through three firing elevations. (Author Modified Abstract) GRA

N73-24941# Arizona Univ., Tucson.
A THEORETICAL STUDY OF ACCIDENTAL INITIATION OF ENCASED HIGH EXPLOSIVE CHARGES BY GAS COMPRESSION MECHANISMS Technical Report, 1 Sep. 1970 - 28 Feb. 1973
Alan D. Randolph and Kenneth O. Simpson Feb. 1973 44 p refs
(Contract F44620-70-C-0088; AF Proj. 9711)
(AD-758255; AFOSR-73-0524TR) Avail: NTIS CSCL 19/1

Non-shock initiation of large encased High Explosive (HE) charges was theoretically investigated with idealized, yet realistic, models which consider the rapid closure of an air gap upon accidental drop of the device. Air void compression is one of the three fundamental thermal stimuli mechanisms that have been proposed for non-shock initiation of HE. The study considers this mechanism as applied to the initiation hazards of a large encased HE weapon system having an internal failure (a separation crack between HE and case or in the HE) and attempts to assess the likelihood of gap compression as a viable mechanism of initiation for the kinds of drop times, gap thickness, and HE physical and thermochemical properties that are likely to exist when a weapon is accidentally dropped. The work to date has investigated conductive distributed-temperature and radiative lumped-temperature thermal models. The calculations establish the possibility of gap initiation and establishes the ranges over which such mechanisms are likely to occur. (Author Modified Abstract) GRA

N73-24942# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.
PERIODICITY OF COMBINED HEAT TRANSFER FROM HORIZONTAL CYLINDERS
Shrinivas K. Nayak and Virgil A. Sandborn Mar. 1973 139 p refs
(Contract N00014-68-A-0493-0001; NR Proj. 062-414; Proj. Themis)
(AD-757993; CER72-73SKN-VAS23; THEMIS-CER-TR-22) Avail: NTIS CSCL 20/4

Based on experimental and flow visualization studies, a model for directly opposed free and forced convection flow around a heated cylinder (0.01 mm diameter) was developed. Three modes of flow were identified. For velocities less than 15 cm/sec (cylinder Reynolds number = 0.08) a free convection or a buoyant force dominated flow was observed. For velocities greater than 15 cm/sec but less than 21.4 cm/sec the magnitudes of the forced and free convection flows were nearly equal. A periodic oscillation of the stagnation region was observed. For velocities greater than 21.4 cm/sec the forced convection was found to dominate over the free convection. The stagnation region was fixed for each flow velocity at one position above the cylinder. (Author Modified Abstract) GRA

N73-24943# Applied Theory, Inc., Los Angeles, Calif.
NUMERICAL STUDY OF PLUME INDUCED FLOW SEPARATION Semiannual Technical Report
L. Walitt, D. C. Wilcox, and C. Y. Liu Mar. 1973 96 p refs
(Contract N00014-71-C-0331; ARPA Order 1701)
(AD-758009; ATR-72-33-1) Avail: NTIS CSCL 16/3

Laminar Mach 26 flow past a blunt-nosed cone with a spherical after-body that injects mass axially from its base into the air, was studied in two finite difference calculations. The mass injection rate for both calculations was 0.15 lb/sec, and Reynolds numbers relative to base diameter were 735 and 4150. Computations were performed with a code (AFTON 2A) which, apart from discretization error, generates solutions to the time-dependent Navier-Stokes equations for axisymmetric systems that contain mass-injecting bodies. In both cases steady flow was approached asymptotically in time from initial flow fields derived from simple inviscid theory. (Author Modified Abstract) GRA

N73-24944# Photochem Industries, Inc., Fairfield, N.J.
PHOTOCHEMICAL ENHANCEMENT OF COMBUSTION AND MIXING IN SUPERSONIC FLOWS
A. E. Cerkanowicz Mar. 1972 59 p refs
(Contract F44620-70-C-0051; AF Proj. 9711)
(AD-758802; PII-3036-1; AFOSR-73-0563TR) Avail: NTIS CSCL 21/2

Initiation and combustion enhancement of gaseous (vaporized or atomized) fuel-air mixtures can be produced photochemically

by ultra-violet irradiation in both stationary and flowing mixtures. Induced combustion characteristics are different from normal thermal ignition (e.g., spark plug), and provide for ignition and enhanced combustion at conditions where thermal ignition is impossible. The potential for practical application of photochemically induced effects in chemical energy conversion devices (e.g., aircraft gas turbines, ramjets) is further facilitated by the availability of higher efficiency light sources. The designer is thus provided with a novel and practical method of combustion initiation and enhancement which departs from the usual thermal method. Author (GRA)

N73-24945# Naval Postgraduate School, Monterey, Calif.
AUGMENTING THE HEAT TRANSFER PERFORMANCE OF ROTATING TWO PHASE THERMOSYPHONS M.S. Thesis
Carl Edward Schafer, II Dec. 1972 81 p refs
(AD-758513) Avail: NTIS CSCL 13/1

A Nusselt-type analysis was performed for laminar film condensation on the inside of a truncated rotating cone. Studies of this model revealed that the heat transfer capacity of the rotating thermosyphon was controlled by three thermal resistances; the condensate film thickness, condenser wall resistance, and the external heat transfer coefficient. A parametric study of the solution was performed for various values of these resistances and methods for reducing them were investigated. A stainless steel thermosyphon was tested using various working fluids. A copper thermosyphon was constructed and tested using water. Different power levels and speeds of rotation were investigated. Longitudinal grooving was studied as a means of reducing the heat transfer resistance of the internal condenser surface. An analytical model was developed for a triangular groove profile and a parametric analysis performed to show effects on heat transfer capabilities. Author (GRA)

N73-24030 Ministry of Aviation, London (England).
THERMAL STRESSES NEAR THE ROOTS OF RECTANGULAR WINGS
G. G. Pope *In* ARC Res. on Aerodyn. Characteristics and Control, Boundary Layers, and Instruments during 1960, Vol. 2 1972 p 1477-1494 refs Previously issued as RAE-STRUCT-254; ARC-22143 (For availability see N73-24011 15-01)
(ARC-R/M-3236; RAE-STRUCT-254; ARC-22143)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N73-24946*+ National Aeronautics and Space Administration, Washington, D.C.
MANAGEMENT: A CONTINUING LITERATURE SURVEY WITH INDEXES, MARCH 1973
Mar. 1973 116 p refs
(NASA-SP-7500(07)) Avail: NTIS HC $3.00 CSCL 05A

This special bibliography lists 389 reports, articles, and other documents introduced into the NASA scientific and technical information system in 1972. Author

N73-24947* National Aeronautics and Space Administration, Washington, D.C.
SIGNIFICANT NASA INVENTIONS AVAILABLE FOR LICENSING IN FOREIGN COUNTRIES
1973 58 p
(NASA-SP-7038(01)) Avail: SOD HC $0.60 Domestic Postpaid or $0.40 GPO Bookstore CSCL 05B

Abstracts are provided of various NASA-owned inventions which are available for foreign licensing in identified countries in accordance with the NASA Foreign Patent Licensing Regulations. Author

N73-24948*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A MODEL FOR ESTIMATING THE COST IMPACT OF SCHEDULE PERTURBATIONS ON AEROSPACE RESEARCH AND DEVELOPMENT PROGRAMS
Donald F. Bishop Aug. 1972 80 p refs
(NASA-TM-X-64748) Avail: NTIS HC $6.00 CSCL 05A

The problem of determining the cost impact attributable to perturbations in an aerospace R and D program schedule is discussed in terms of the diminishing availability of funds. The methodology from which a model is presented for updating R and D cost estimates as a function of perturbations in program time is presented. Author

N73-24949# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
[AEROSPACE RESEARCH PROJECTS, INCLUDING PLASMA DYNAMICS AND AERODYNAMICS STUDIES] Annual Progress Report, 1972
Dec. 1972 154 p refs
Avail: NTIS HC $9.75

Research activities are reported for this period. Studies discussed include: composite materials, UTIAS-industrial research programs, high performance equipment for processing pictures, spacecraft dynamics and control, space simulation facilities, plasma and laser science, sonic boom simulation, and air cushion vehicle. F.O.S.

N73-24950# Committee on Aeronautical and Space Sciences (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1974
Frank E. Moss Washington GPO 1973 126 p Report to accompany H.R. 7528 presented by Comm. on Aeron. and Space Sci. at the 93d Congr., 1 Sess., 30 May 1973
(S-Rept-93-179) Avail: NTIS Avail: US Capitol, Senate Document Room

The report is presented concerning the 1974 appropriations to NASA for R and D, construction of facilities, research and program management, and for other purposes. Modifications to existing facilities and rehabilitation projects are included. F.O.S.

N73-24951# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT AND PRACTICAL APPLICATION OF SYSTEMS ANALYSIS
V. I. Bohdanovych, V. T. Kulyk, and A. I. Uyomov 7 May 1973 11 p refs Transl. into ENGLISH from Filosofska Dumka (kiev), no. 1, 1973 p 10-16
(JPRS-58935) Avail: NTIS HC $3.00

Discussion is made of the general characteristics of problems inherent in the planning and management of the Soviet national economy in terms of the application of systems analysis. Author

N73-24952# Joint Publications Research Service, Arlington, Va.
IMPROVING CONTROL OF SCIENTIFIC-TECHNICAL PROGRESS
M. Vilenskiy 9 May 1973 22 p refs Transl. into ENGLISH from Vop. Ekon. (Moscow), no. 2, Feb. 1973 p 109-120
(JPRS-58976) Avail: NTIS HC $3.25

The problems involved in the control of the Soviet national economy as it is affected by the acceleration of scientific-technical progress are discussed. Author

N73-24953*# Linguistic Systems, Inc., Cambridge, Mass.
SPACE AND EDUCATION
O. M. Belotserkovskiy Washington NASA May 1973 53 p refs Transl. into ENGLISH from the Publ. "Kosmos i Obrazovaniy" Znaniye Press, Moscow, 1972 32 p
(Contract NASw-2482)
(NASA-TT-F-775) Avail: NTIS HC $3.00 CSCL 05I

Communications satellite systems are discussed for use in educational television systems. Soviet educational television programs by Central Television of the USSR, GENESYS, and Sunstar in the USA are discussed along with the EDUSAT project, and the Indian national television satellite system being developed in cooperation with NASA. A theoretical discussion of a system for Argentina and neighboring countries is included. Author

N73-24954*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
DIRECTORY OF WORKERS IN THE FIRE FIELD

Boris W. Kuvshinoff, Stephen B. McLeod (NBS, Gaithersburg, Md.), and Richard G. Katz (NBS, Gaithersburg, Md.) Feb. 1973 135 p
(NASA Order C-506273; Grant NSF GI-12)
(NASA-CR-121149) Avail: NTIS HC $8.75 CSCL 05A

A directory was compiled to provide a list of workers engaged in fire research, their addresses and affiliations, and their principal fields of activity. The initial criteria for the selection of names for the directory are recent contributions to fire literature, teaching of subjects relevant to fire science, or participation in or support of fire research programs. With some exceptions, fire service personnel and fire protection engineers were excluded because directories already exist for these professionals. Also excluded are investigators engaged principally in studies of propulsion, combustion, and explosion phenomena, because these areas of study are somewhat aside from the main focus of fire research. For purposes of the directory, fire science is taken to be the body of knowledge, art, and skill related to the investigation, analysis, and interpretation of the phenomena of unwanted fires and the evaluation of materials methods, systems, and equipment related to fire safety, prevention, detection, and suppression. Author

N73-24955*# National Academy of Sciences - National Research Council, Washington, D.C.
THIRTEENTH GENERAL ASSEMBLY AND CONGRESS OF THE INTERNATIONAL UNION FOR THEORETICAL AND APPLIED MECHANICS Final Report
[1972] 181 p refs
(Contract NASw-2393)
(NASA-CR-132236) Avail: NTIS HC $11.25 CSCL 05A

The participation by visiting U.S. scientists to the 13th International Congress of Theoretical and Applied Mechanics in Moscow are presented. Brief summaries of the lectures are included. F.O.S.

N73-24956*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SYSTEMS APPROACH TO THE MANAGEMENT OF LARGE PROJECTS: REVIEW OF NASA EXPERIENCE WITH SOCIETAL IMPLICATIONS
Michael J. Vaccaro May 1973 11 p refs
(NASA-TM-X-66251; X-100-73-146) Avail: NTIS HC $3.00 CSCL 05A

The application of the NASA type management approach to achieve objectives in other fields is considered. The NASA management outlook and the influences of the NASA environment are discussed along with project organization and management, and applications to socio-economic projects. F.O.S.

N73-24957*# National Aeronautics and Space Administration, Washington, D.C.
INTERNATIONAL PROGRAMS
May 1973 28 p
(NASA-TM-X-69259) Avail: NTIS CSCL 05D

Brief summaries are given of NASA's participation in international space programs. This participation can be categorized in five principal areas: manned space flight, space sciences, space applications, ground support of space operations, and cooperative international aeronautics research. All projects are carried out on a cooperative or reimbursable basis. A.L.

N73-24958# National Science Foundation, Washington, D.C.
FEDERAL FUNDS FOR RESEARCH DEVELOPMENT AND OTHER SCIENTIFIC ACTIVITIES, FISCAL YEARS 1971 - 1973, VOLUME 21
Jane Pugh 1972 210 p
(NSF-72-317) Avail: SOD $2.75

Comprehensive statistical information is provided on the size and scope of Federal funding for research and development and on the types of institutions and purposes to which such funds are directed. This information is intended for makers of science policy in and out of government, those who study scientific trends, and all others interested in the role of science in the nation. Author

N73-24959# National Science Foundation, Washington, D.C.
A PRICE INDEX FOR DEFLATION OF ACADEMIC RESEARCH AND DEVELOPMENT EXPENDITURES
Sidney A. Jaffe 1972 35 p refs
(NSF-72-310; LC-72-600236) Avail: SOD $0.25

Price trends affecting R and D activities at academic institutions are analyzed and interpreted. Information on faculty compensation as well as on other pertinent expenses is provided with emphasis on the period from FY 1971 to FY 1972. J.M.M.

N73-24960# National Science Foundation, Washington, D.C.
NATIONAL PATTERNS OF RESEARCH AND DEVELOPMENT RESOURCES: FUNDS AND MANPOWER IN THE UNITED STATES, 1953 - 1973
1973 46 p refs
(NSF-73-303) Avail: SOD $0.80 Domestic Postpaid or $0.55 GPO Bookstore

A summary is presented of the national patterns of R and D funding and manpower allocations attributed to the four sectors of the economy - Federal Government, industry, universities and colleges, and other nonprofit institutions. Time series data on R and D funds, over the period from 1953-73; manpower data begin with 1954. R and D funding data used were obtained from various NSF surveys, generally conducted on an annual or biennial basis. Author

N73-24961*# George Washington Univ., Washington, D.C.
TECHNOLOGY APPLICATIONS Annual Progress Report, 1 Jan. - 31 Dec. 1972
Dec. 1972 53 p
(Contract NASw-2055)
(NASA-CR-132148) Avail: NTIS HC $4.75 CSCL 05B

A review was made of recent and current efforts to apply aerospace derived solutions to nonaerospace problems. Specific problems discussed include transportation, environmental pollution and abatement, housing and urban construction, firefighter equipment, and mine safety. Medical diseases and equipment are also discussed. E.H.W.

N73-24962# European Space Research Organization, Paris (France).
PROJECT MANAGEMENT AND PROJECT CONTROL
Jan. 1972 428 p refs Partly in ENGLISH and partly in FRENCH Proc. of the 10th ESRO Summer School, Frascati, Italy, Sep. 1972
(ESRO-SP-90) Avail: NTIS HC $23.50

To encourage and promote the further advancement of the state of the art in systematic project management a forum for the exchange of the relevant knowledge and experience was provided. The sessions cover the following topics: introduction to project management and project control; project management; systems engineering; phased project management; project planning and control; contract management; and future trends in project management. For individual titles, see N73-24963 through N73-24992.

N73-24963 European Space Research and Technology Center, Noordwijk (Netherlands).
INTRODUCTION TO PROJECT MANAGEMENT AND PROJECT CONTROL
O. Hammarstroem *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 5-14 (For availability see N73-24962 15-34)

The need for project management is discussed and important aspects of the project manager's duties are outlined. The vertical and horizontal reporting lines are discussed and the integration of a project management organization into a company described. The functions of the project team are considered and the goals, objectives and tasks of the project management established. Project control is also briefly reviewed. ESRO

N73-24964 Kernforschungsanlage, Juelich (West Germany).
MOTIVATION, PLANNING AND MANAGEMENT OF RESEARCH AND DEVELOPMENT PROGRAMMES
Hermann L. Jordan *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 15-24 (For availability see N73-24962 15-34)

In many fields of science and technology, progress has led to a rapid expansion of research and development potential and a growing demand for funds and facilities. Particularly in

Government financed areas of research and advanced technology the aspects of relevance, priorities and efficient use of limited resources have become of steadily growing importance. Based on experience in larger research and development programs, the lecture deals with strategy, setting of objectives and the evaluation of such programs with a particular emphasis on the aspects of innovation, relevance, use of limited resources and the motivation of scientific and technological personnel. Since in many such efforts international cooperation is necessary, additional potentialities and constraints of international programs are also considered. The European community program on controlled thermonuclear fusion is cited as example.
Author (ESRO)

N73-24965 Paris Univ., Orsay (France).
INTEGRATING PROJECTS AND CONTRACTS INTO THE PROGRAMME OF A RESEARCH AND DEVELOPMENT CENTRE
J. Gueron *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 25-31 (For availability see N73-24962 15-34)

The problems encountered by a research center director and/or project manager in adjusting their retrospective jobs, in separating the R & D subjects to be assigned to outside contractors from those to be tackled internally and in selecting contractors, are discussed using as examples nuclear graphite manufacture, and the Dragon and Orgel projects. ESRO

N73-24966 Eurosat S.A., Geneva (Switzerland).
THE CONCEPT OF PROJECT MANAGEMENT
P. Blassel *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 33-41 (For availability see N73-24962 15-34)

The basic concept of project management is described and the definition and acceptance of the mission objectives, definition of project approach and evaluation of resources were discussed. The data collection system and the processing and presenting of the information are considered. The preparation, making and executing of decisions are also stressed. ESRO

N73-24967 European Space Research and Technology Center, Noordwijk (Netherlands).
PROJECT MANAGEMENT IN THE AEROSPACE INDUSTRY
O. Hammarstroem *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 43-53 (For availability see N73-24962 15-34)

The aerospace industry has been a pioneer in the field of project management and many of the concepts and methods currently used in the management of R and D and production projects have been developed in aerospace work. The particular aspects of project management in the aerospace industry are discussed together with the scope of programs necessitating a high degree of delegation of responsibility. The project management organization especially with regard to multinational projects is considered and customer requirements are taken into account. ESRO

N73-24968 European Space Research and Technology Center, Noordwijk (Netherlands).
PROJECT MANAGEMENT AND THE HUMAN FACTOR: A SYSTEMS APPROACH
D. E. Mullinger *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 55-69 (For availability see N73-24962 15-34)

The project management system and application of the management method is discussed. The method includes definition of objectives and overall system, project requirements and implementation. The management structure is described and management tools are summarized. Problems and their solving are considered and the benefits accruing from the project are emphasized. ESRO

N73-24969 European Organization for Nuclear Research, Geneva (Switzerland).
ORGANISATION AND MANAGEMENT OF THE CERN/ISR PROJECT c22
C. J. Zilverschoon *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 71-76 (For availability see N73-24962 15-34)

Credit for the success of the CERN intersecting storage rings project was due to the nature, structure, personnel and financial procedures in the organization; the integration of industry into the program; the organization of the project group and project control. A short description of each of these points is given.
ESRO

N73-24970 European Space Research and Technology Center, Noordwijk (Netherlands).
ORGANIZATION AND MANAGEMENT OF THE ESRO 4 SATELLITE PROJECT
Jean-Francois Lafay *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 77-87 (For availability see N73-24962 15-31)

After some general information on the main characteristics of the ESRO 4 project, the organization of the project within ESRO is discussed. The ESRO 4 project group and its relationships with specialized divisions of ESTEC or other ESRO establishments, the launching agency and the scientific experimenters are considered. The industrial organization of the ESRO 4 project is briefly covered and the relationship between the ESRO 4 project group and the prime contractor is outlined. The management plan is presented, defining the various responsibilities and the procedures for the technical control, schedule control and modification control. The influence on the management of the type of contract with the prime contractor is analyzed. Special emphasis is placed on the interfaces with the prime contractor for equipment under direct control of ESRO. The difficulties which can be encountered in this type of management are outlined and possible solutions are suggested. Author (ESRO)

N73-24971 Elliott-Automation Space and Advanced Military Systems, Ltd., Camberley (England).
PROJECT MANAGEMENT COMPARISON
L. A. Mitchell *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 89-100 (For availability see N73-24962 15-34)

A brief description of EASAMS Ltd. and of the type of project undertaken there is followed by an analysis of the principle on which the management of the company and the project management are based: delegation of appropriate authority; careful pre-planning; control of commitment; and identification of cost centers. A comparison of the various management factors in two different types of project - a military development project and civil engineering projects - is then developed with particular reference to selection of objectives, organization for management, choice of the management staff, and effectiveness of the different procedures. Finally, a summary of the planning processes is given with examples of problems and solutions, bringing out the similarity of management problems in widely differing projects.
Author (ESRO)

N73-24972 General Electric Co., Philadelphia, Pa. Space Div.
SYSTEMS ENGINEERING AS A DECISION MAKING TOOL
Francis W. Pfluger *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 101-107 (For availability see N73-24962 15-34)

A definition of the objectives of the systems engineering function is given followed by a general description of the method of achieving these objectives. A definition is then given of the qualifications of a systems engineer and his specific function during each of the various phases of a space systems project is discussed. ESRO

N73-24973 European Space Research and Technology Center, Noordwijk (Netherlands). Satellites and Sounding Rockets Dept.
SYSTEMS ENGINEERING AND PROJECT MANAGEMENT OF THE ESRO 1 SATELLITE c31
Manfred G. Grensemann *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 109-128 (For availability see N73-24962 15-34)

After a brief summary of the ESRO 1 satellite mission objectives and technical design, detailed consideration is given to the development phase of the ESRO 1 satellite and the solutions adopted to overcome technical and planning problems. The planning methods used, such as PERT and bar charts, and the reporting system are described. Author (ESRO)

N73-24974 TRW Systems International, Inc., Brussels (Belgium).
MANAGING A CONTRACT (PROJECT) SPECIFICATION SYSTEM FOR SATELLITE PROJECTS
Dale Eugene Miller *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 129-142 (For availability see N73-24962 15-34)

A model scheme of a cost effective contract specifications management program is presented to effect understanding of project specification management needs. It emphasizes the lessons learned from past satellite projects and reflects the future ESRO approach. ESRO

N73-24975 European Space Research Inst., Frascati (Italy).
SPACE POLITICS OF THE EUROPEAN SPACE RESEARCH ORGANIZATION [LA POLITIQUE INDUSTRIELLE DU CERS]
J. Dinkespiler *In its* Proj. Management and Proj. Control Jan. 1973 p 143-161 In FRENCH (For availability see N73-24962 15-34)

After a resume of the reasons why an industrial policy is necessary and important for ESRO the objectives and means of realization of such a policy are described. The following principal subjects are broached and commented on: geographical distribution of contract; formation of multinational consortia; technological research; and the relevant procedures. In conclusion, the importance of a European industrial potential in space matters is underlined by the changing attitude of the United States towards cooperation with Europe. ESRO

N73-24976 European Space Research Inst., Frascati (Italy).
THE EUROPEAN SCIENTIFIC COMMUNITY AS USERS OF ESRO SATELLITE SYSTEMS
J. Ortner *In its* Proj. Management and Proj. Control Jan. 1973 p 163-172 (For availability see N73-24962 15-34)

The principles and objectives of the European space research organization are discussed. These give scientists the opportunity of placing their experiments onboard satellites, having them integrated, tested and launched, and then collecting the data obtained by them. The relationship between ESRO and the scientist is traced and the procedures for experiment proposals are outlined. ESRO

N73-24977 European Space Research and Technology Center, Noordwijk (Netherlands). Systems Studies Div.
WHY PLAN AND MANAGE IN PHASES?
J. B. Lagarde *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 173-176 (For availability see N73-24962 15-34)

Definitions of the meaning of plan, manage and phases are given. The reasons are then analyzed why an overall task is divided in subtasks or phases, and the drawbacks of this partitioning concept are emphasized. ESRO

N73-24978* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PHASED PROJECT PLANNING AND DEVELOPMENT IN ANTICIPATION OF OPERATIONAL PROGRAMS
W. G. Stroud *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 177-187 refs (For availability see N73-24962 15-34)

The impact of future operational status on the planning and execution of the research and development activities for major space flight projects is assessed. These projects, within NASA, are part of the Applications Program involving communications and meteorology. The NASA management approach to these projects is determined by national policies governing the responsibilities and relationships among the various government agencies and private industries. ESRO

N73-24979 European Space Operations Center, Darmstadt (West Germany). Programme Management Div.
THE PHASED PREPARATION OF GROUND FACILITIES FOR SATELLITE MISSIONS
Louis Antony Potter *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 189-200 (For availability see N73-24962 15-34)

A general description of the ESOC ground facilities (network of stations, control center, computer center) and the organization required for their design, preparation, operation and management is given. The various phases of the preparation of the facilities for a new mission are then discussed, followed by an account of the planning and management procedures used at ESOC. Emphasis is then placed on the problems of achieving satisfactory relationships between the various phases of the different projects, both in manpower resources and availability of facilities. Details of the procedures utilized are presented. In conclusion, examples are given of various phases in the life of a control center as the various projects progress through preparation and operation. Author (ESRO)

N73-24980 Philips Electrologica N.V., Apeldoorn (Netherlands).
THE PHASED DEVELOPMENT OF NEW INDUSTRIAL PRODUCTS
K. T. A. Halbertsma *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 201-224 refs (For availability see N73-24962 15-34)

Almost all new industrial products pass through seven phases: conception, definition, design, prototype, manufacturing, sales, and operation. Committing so many years to the development of a new product before marketing can begin implies high risks and high investments in capital and human resources, thus rigid planning and control are essential. The human resources consist of talented and educated people, demanding a relatively high degree of individual responsibility, authority, leeway and professional satisfaction. These requirements can be met by systems management within a functionally structured organization. The planning and control at corporate level are limited to, and focussed at, the baselines separating the phases. The project managers and the supporting departments work in a matrix configuration, providing the flexibility to allocate authorities, responsibilities and leadership in an optimum way according to the different phases. Author (ESRO)

N73-24981 European Space Research and Technology Center, Noordwijk (Netherlands).
WHY PROJECT CONTROL?
Hellmuth Gehriger *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 215-224 refs (For availability see N73-24962 15-34)

Project control is focussed on two very important management control parameters: time and cost. It must encompass all project phases, from conception of a system to its acquisition and start of operations. Plans covering all project phases ahead are developed very early and are progressively detailed and refined as the system to be acquired passes through and evolves from the various project phases. At the end of each phase, detailed and accepted control plans, such as project networks, manpower budgets and cost estimates, are available which can be used to monitor the evolution of the project elements, to detect unfavorable trends early and to warn management such that corrective action can be taken in good time and with a high chance of success. Project control wants to ensure that the project initiator gets value for money. The specific techniques and methods used to achieve this goal are explained in detail. A review is given of the total project control system in operation at ESTEC, as well as a description of how the individual techniques of project network analysis, phased project planning, work package cost control and contracts management have been integrated into a self-contained operational entity and successfully applied to several projects. Author (ESRO)

N73-24982 European Space Research and Technology Center, Noordwijk (Netherlands).
ASPECTS OF PROJECT CONTROL FIELD OPERATIONS
Peter D. Biggs *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 225-239 (For availability see N73-24962 15-34)

The organization of a project control field team is described by indicating the requirements and functions of ESRO project control in comparison with industrial companies. Details are given on the requirements and tasks to be performed in the various types of projects during advanced phases. Particular attention is drawn to the selection of PC personnel, their qualifications and relationship with the project group. The importance of the physical location of a PC team is substantiated. The specific techniques and methods used by ESRO for monitoring work progress, manpower consumption and cost evaluation are explained. Special consideration is given for the delicate problems of PC, such as: the handling of project participants who lack management systems experience; how to cope with inadequate baseline plans and estimates; how to overcome poor reporting, and etc. All essential factors in running effective PC field operations are pointed out using practical examples from the latest online experience in an advanced ESRO satellite project. Author (ESRO)

N73-24983 European Space Research and Technology Center, Noordwijk (Netherlands).
DATA PROCESSING IN PROJECT CONTROL c08
P. R. Knight *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 241-258 (For availability see N73-24962 15-34)

After a brief introduction on electronic data processing and its major hardware and software constituents, the sectors in project control which are preferable targets for automation are outlined, such as: network analysis and updating, cost analysis and control, resource allocation and, leveling, trend analysis and extrapolation, condensation and formatting of management information, documentation control, configuration control, simulation, and etc. The reasons for their selection are indicated. Criteria and their importance when having to select the optimum data processing system are discussed. The requirements to be imposed on the users are enumerated and their coherence explained. Finally, the coming data processing demands in project control systems are outlined. Author (ESRO)

N73-24984 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Space Div.
COST ESTIMATING AND PRICE ANALYSIS IN SATELLITE PROJECTS
A. Franzke and K. Niebisch *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 259-287 refs (For availability see N73-24962 15-34)

The latest state-of-the-art methods techniques and practices used for systematic cost and price analysis in European aerospace activities are comprehensively reviewed. A survey of several statistical spacecraft cost formulae is given and a new formula with increased prediction accuracy is presented. The topics discussed include: definition of the baseline documentation required for manpower and cost estimating when tendering; work breakdown structures; types of cost; stages of cost evolution; statistics; handling of cost escalation factors; and influence of reliability requirements on spacecraft cost. Using some practical examples the application of a number of specific estimating techniques and analysis is demonstrated including the use of projected correction factors derived from previous contracts, and the evaluation by means of a matrix system based on existing, modified, or new technologies. Author (ESRO)

N73-24985 European Space Operations Center, Darmstadt (West Germany). Programmes and Mission Management Dept.
INTEGRATED PROJECT CONTROL IN A MATRIX ORGANIZATION
Jerry Asger Jensen *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 289-298 (For availability see N73-24962 15-34)

The European Space Operations Centre (ESOC) is responsible for the provision of the ground segments in ESRO satellite projects as well as for operating the space satellite systems once the satellites are launched. The complexity of such a program puts rather a high demand on the management structure and the project control system in use. This was the basis for developing the requirements for an ideal planning and management system, which is constantly pursued. The approach in project control for meeting these requirements is outlined and the application of the chosen project control system to the HEOS-A2 and TD-1 satellite mission readiness is described. How the control plans were developed from the baselines, and the difficulties encountered are indicated and the appropriate remedies which were successfully applied are described in some detail. The present state of affairs after the recent introduction of the PMS-360 resource allocation computer program is outlined.
Author (ESRO)

N73-24986 European Space Research and Technology Center, Noordwijk (Netherlands). Telecommunications Satellite Div.
MODIFICATION CONTROL IN AEROSPACE
Albert L. Moratti *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 299-314 (For availability see N73-24962 15-34)

Large, complex R and D projects where the probability of redirection is extremely high, are described. The resultant strong potential effect on cost, schedule and documentation requires strict control of modifications. The various aspects involved are highlighted and particular attention is given to the following points: the need for modification control in documentation, cost, and schedule; flexibility of modifications in different types of contracts from contractors and customers point of view; types of changes; basic steps involved in modifications; and requirements for a solid working base in the evaluation of changes. Author (ESRO)

N73-24987 European Space Research and Technology Center, Noordwijk (Netherlands). Contracts Div.
CONTRACTS MANAGEMENT AT ESTEC
W. Thoma *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 315-319 (For availability see N73-24962 15-34)

The ESRO tender requirements on projects are presented under the specific aspect of analysis and clarity required. The basic idea being that a good tender preparation saves many negotiations at a later stage. The specific contract provisions required to keep the project transparent are discussed: clear definition of responsibilities, reporting, modification control, and motivation of the contractor to keep his commitments.
Author (ESRO)

N73-24988 Kienbaum Unternehmensberatung, Gummersbach (West Germany).
DEGREE OF INNOVATION, RISK MANAGEMENT AND CONTRACTING
Karl-Heinz Ruesberg *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 321-332 refs (For availability see N73-24962 15-34)

The risks and possible consequences inherent in modern technology projects are made apparent and quantifiable. A distinction is made according to whether projects use entirely available technology or require the development of entirely or partially new technology. The project is considered in its entirety as an organism, bearing in mind all the relevant technical, economical, sociological and ecological parameters. For projects with a high degree of innovation, it's not appropriate to select total package procurement (as opposed to phased procurement). Instead, each phase of the project should be made the subject of separate but coherent contracts, in order to enable the project being redirected or modified without difficulties.
Author (ESRO)

N73-24989 European Space Research and Technology Center, Noordwijk (Netherlands).
INCENTIVE SCHEMES AS A CONTRACT MANAGEMENT TOOL
L. Vandaput *In* ESRO Proj. Management and Proj. control Jan. 1973 p 333-348 refs (For availability see N73-24962 15-34)

The users of project management techniques show a great interest in, and develop a continuing sophistication of incentive schemes. The organization is interested in a product to be developed within a given budget and delivered at a given time according to the initial specifications. If the contractor has fulfilled these conditions, the organisation is prepared to pay him a reward, the amount of which has to be negotiated between both parties - keeping in mind the three parameters, cost, delivery and performance, to form the basis of each incentive system. The incentive scheme used in the ESRO-4 satellite contract is presented in order to show the practical application of such a system. Emphasis is put on the elaboration phase of the system and on the analysis of the contractor's proposal. Author (ESRO)

N73-24990 European Space Research Organization, Paris (France).
PROJECT MANAGEMENT INFORMATION REQUIREMENTS IN AN INTERNATIONAL ORGANISATION
Roy Gibson *In its* Proj. Management and Proj. Control Jan. 1973 p 349-352 (For availability see N73-24962 15-34)

Only the case of international organizations which have the direct responsibility for a major R and D project is considered. The requirements of member states are examined, as is the need to steer a course between unnecessary interference in the day-to-day control of the project and lack of viability into the cost, schedule and even the real utility of the project on the part of those who are paying for it. The role of the secretariat is discussed, and in particular the extent to which it is permissible for the secretariat to develop aims in its own right. The danger is noted of the secretariat not always being wholly aware of the motivations of its project managers. The international

organizations' relations with industry in the conduct of a major project and the difficulties involved in retaining the initiative necessary to ensure a successful project, are discussed with some final remarks on the practical importance of human aspects in project management. Author (ESRO)

N73-24991 Eurosat S.A., Geneva (Switzerland).
FUNCTIONAL SUPPORT DEMANDS IN A MULTI-PROJECT INSTITUTION
P. Blassel *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 353-361 (For availability see N73-24962 15-34)

The organization of the work for the execution of a project taken in isolation calls for a delicate balance between project oriented tasks, performed by project personnel, and specialized contributions, provided by functional support groups. In a multi-project institution, functional support groups have to serve at the same time and from limited resources several projects of varying degrees of complexity and at various stages of advancement. A close loop information and management system is described which is intended to assist the functional support group in planning ahead the possibilities of their resources with a view to limiting a priori possibilities of conflict between projects. The presentation shows the danger of an inadequate functional support base in a multi-project institution. Author (ESRO)

N73-24992 General Electric Co., Philadelphia, Pa. Space Div.
FUTURE TRENDS IN PROJECT MANAGEMENT
Francis W. Pfluger *In* ESRO Proj. Management and Proj. Control Jan. 1973 p 363-372 (For availability see N73-24962 15-34)

The objectives of the management function are defined and a logical derivation of the requirements for an effective control system are given. These include the planning, communication and analysis subsystems. The degree to which current systems fulfill these requirements are noted. The factors which have impeded the implementation of the optimum system are identified and methods by which these impediments can be overcome are discussed. A prediction of the advancements in technique which can be expected in the future is made. ESRO

N73-24993# ARO, Inc., Arnold Air Force Station, Tenn.
AERODYNAMIC FORCES AND TRAJECTORIES OF SEPARATED STORES DISTURBED FLOW FIELDS Final Report, 16 Aug. 1971 - 30 Jun. 1972
W. N. MacDermott and P. W. Johnson AEDC Mar. 1973 102 p refs
(ARO Proj. PW5280)
(AD-757932; ARO-PWT-TR-72-148; AEDC-TR-72-162) Avail: NTIS CSCL 19/2

A vortex-lattice potential flow computer program capable of accepting nonuniform flow boundary conditions but previously restricted to incompressible flows with symmetry was modified to eliminate these restrictions. The program was structured in such a way that, after preliminary calculations of a purely geometric nature were performed one time for a given body, potential flow solutions for any set of boundary conditions on that body could be obtained in computer times measured in seconds rather than minutes. The aerodynamic characteristics of an M-117 bomb, represented by a network of 312 vortices, were calculated for uniform flow at a Mach number of 0.5 and were found to agree with wind tunnel measurements to within 10 percent, except for drag. (Author Modified Abstract) GRA

N73-24994# Center for Naval Analyses, Arlington, Va. Warfare Analysis Group.
DIVE AND GLIDE ERROR SENSITIVITY PROGRAM FOR IBM 7090 Interim Report
Janet K. Buckley and Phil E. Depoy 17 Aug. 1962 17 p refs
(AD-758420; NWAG-IRM-11) Avail: NTIS CSCL 19/5

The memorandum describes an IBM 7090 computer program for determining values of error sensitivity for dive and glide bombing with free-fall weapons. Sensitivities of the weapon impact point to small deviations from planned release conditions are computed assuming vacuum trajectories of the weapons.
Author (GRA)

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